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FOREST PRESERVATION.

It is comforting to learn that a new forest reserve bill has been introduced in Congress by Representative Lever, of South Carolina, which it is hoped will meet the constitutional objections of the Judiciary Committee to the former Appalachian reserve bill. The new bill looks to the purchase of large areas in the southern stretches of the Appalachian Highlands and in the White Mountains. To meet the objections which have been made, it provides that all purchases shall be made only with the consent of the owner of the tract in question and of the legislature of the state in which the tract is situated. Civil and criminal jurisdiction over the land to be purchased is to remain in the courts of the state. The bill expressly stipulates that no improved farm land shall be included. Mining and timber rights are to remain with the present owners and ten per cent of the receipts from the forest reserve are to be paid to the state.

The bill first proposed had the support of a large number of technical and industrial associations. It was intended to prevent the rapid exhaustion of our forests, which is now going on. There are a large number of industries directly and indirectly dependent upon the preservation of the forests. It has been estimated that at the present rate of consumption and with the methods of lumbering now in force, that our lumber resources will be exhausted in about thirty years. A good deal of this destruction is due to improper methods of lumbering, but the greater part is caused by improper care of the forests. The annual destruction by fires is enormous, and but little attention is paid to reforesting sections which have been cut.

Moreover, the destruction of forests is bringing about the ruin of the new farming country. This is particularly true in the South, where the soil is easily washed by the rains from the hillsides and carried into the valleys, thus spoiling both the uplands and the lowlands. When the trees are gone, there is nothing to hold the rain in the soil and it runs off quickly instead of being retained in the spongy humus about the trees and being allowed to flow away gradually. The floods which are thus produced not only carry destruction throughout all the land through which the rivers flow, but they carry off in a few hours the water which should, under normal conditions, require months for its gradual draining off.

Another, and very serious, result of this rapid run-off is the effect it has upon the available power of the rivers. The power which may be developed from a river is governed by the average flow. In many cases, indeed, it is the minimum flow which limits the installation. When the greater part of the water flow-

ing down the river comes in a flood, instead of being distributed over a long period, practically all of it rushes past the power site without being utilized, and the available power at that point is correspondingly reduced. Thus wasteful forest methods destroy, not only the lumber resources, but also the power resources of the country, and thus affect seriously all those industries which would be benefited by cheap power.

It is greatly to be hoped that either the new Lever bill or some other satisfactory measure may be enacted by Congress, for it is almost impossible for the states themselves to carry out this reform alone, because a state most interested in the water powers may depend entirely for their preservation upon forests lying in another state. Moreover, the expense of purchasing these reserves would be so large compared with the resources of the individual states, particularly those in the South, that it is hardly to be expected that the state legislatures will appropriate the necessary money. However, it is most desirable that the general government and the states should co-operate in this matter, and it would not be unfair to ask the latter to bear part of the expense of a reform which will be greatly to their advantage. Prompt action is to be hoped, as every year lost will make it harder to recover from the devastation wrought.

AN OSCILLATING ARC FOR WIRELESS SIGNALING.

A good deal has been heard during the last year or so of the advantages of the oscillating arc for transmitting wireless signals. The device is comparatively old, and its use for setting up electrical oscillations of high frequency was thought of some time ago. But the early attempts to secure frequencies sufficiently high for wireless telegraphic purposes are not altogether successful. It remained for Mr. Valdemar Poulsen to improve upon the work of Duddell and others, and to devise an arrangement which would give the necessary frequency. As soon as this had been done and the method by which apparent success had been secured was made known, attention was again directed to the arc, and it at once became an important accessory for wireless telegraphy and telephony.

For these reasons an address delivered recently by Mr. Poulsen, before the London Institute, attracted a good deal of attention, particularly from those who have not been directly associated with the new methods of communication, but who have heard of the excellent work which he has been doing. On the other hand, the lecturer, recognizing the character of his audience, did not go into abstruse mathematical demonstrations nor complicated physical explanations of what had been done, but devoted his time to explaining why the oscillations set up by the arc are superior to those produced by the old type of spark discharge. The latter was likened to an explosion in which a large amount of energy is thrown off in an exceedingly short time. Radiations of this kind will produce enormous effects at short distances, but they die out rapidly, or, as the physicist says, "They are strongly damped." Every conductor with which they come in contact absorbs a certain portion of the energy of radiation; and for the same reason it is difficult to prevent interference at the distances over which the radiation is effective. In other words, radiation of this kind may be likened to the blow of a hammer: everything which can be struck by it feels the effect and protects objects behind it to a greater or less degree.

On the other hand, radiations set up by the arc seem to be very nearly continuous, and while the force exerted at any instant may be comparatively small, when this is exerted for some time upon a body which can respond to the rate of oscillation, considerable effects may be produced. For the same reason a body which does not respond to the rate of vibration is not affected, and hence does not absorb energy from the radiation. The advantage of this is twofold: Due to the decreased damping effect, the radiations will travel for a greater distance than a radiation of the spark-discharge type of equal intensity, simply because bodies not tuned to the proper frequency have little damping effect upon it. On the other hand, when a body is so tuned, it will be more efficient in absorbing the continuous oscillation. Tuning thus becomes a much simpler matter, and interference is avoided.

There are other advantages resulting from those which have been mentioned, which are of considerable importance to the wireless electrical engineer. Due to the persistence of the waves, the same amount of energy may be radiated at a much lower voltage. In spark telegraphy voltages from 50,000 to 100,000 must be secured in order to throw out the necessary amount of energy in the exceedingly brief time during which the discharge takes place. With the undamped oscillations produced by the arc the same distance may be covered with a radiating voltage of only 2,000 or 3,000. This simplifies considerably the problems met in designing the telegraphic or telephonic apparatus, since the insulation problem is comparatively easy.

Mr. Poulsen also explained, during his address, what had been done in wireless telephony. One of the marvels of the speaking telephone is the simplicity of its essential parts. The large, intricate switchboards in the central stations are merely conveniences for connecting two instruments together, and all of this apparatus at the central station is eliminated in the wireless system. The transmitting station contains a microphone transmitter and a singing arc; the receiving station, a thermocouple and a telephone receiver. These, with the transformers for connecting them to the antenna, complete the equipment. Already good success is reported to have been secured over distances of 250 miles. This, of course, depends upon the use of the continuous oscillations produced by the oscillating arc.

An interesting feature of Mr. Poulsen's address was the description and exhibition of an automatic transmitting and receiving system for wireless telegraphy. One of the drawbacks of this system is the slow speed of transmission, which is the more severely felt since a wireless station usually transmits but one message at a time. The new system, which employs a photographic receiver (mechanical apparatus not being rapid enough), is said to transmit words at the rate of two hundred a minute—about ten times greater than the usual rate.

HIGH-SPEED GENERATOR DEVELOPMENT.

In the ELECTRICAL REVIEW for April 25 an interesting paper was published which was read recently by Gerald Stoney and A. H. Law before the Institution of Electrical Engineers, of Great Britain, and which discussed the development of high-speed electrical machinery, with particular reference to the use of the steam turbine as a prime mover. This paper dealt mainly with the work which has been done by a single firm, C. A. Parsons & Company, and, of course, showed only what advance had been made by this one concern. However, in the discussion which followed the reading of this paper, Dr. S. P. Thompson gave some figures which indicated the rather surprising advance in electrical design which has taken place in the past twenty years, most of which has resulted directly from careful, scientific researches.

The advance which has been made was shown by Dr. Thompson by giving the so-called Steinmetz coefficient for the machines built at various periods. This coefficient is obtained by multiplying together the diameter and length of the armature core and dividing the product by the rated kilowatt output of the machine. The coefficient thus obtained is, in a sense, a measure of the utilization of the iron and copper of the armature. Dr. Thompson showed that, beginning in 1884 with a small eight-kilowatt, direct-current machine, the Steinmetz coefficient was 2.4. Five years later, in 1889, this coefficient, for a sixty-kilowatt machine, had gone down to 2.1, thus showing not only a considerable advance in the size of machines, but a reduction in the material used. But the advance since then has been even more surprising, for two recent continuous-current generators, one rated at 750 and the other at 1,000 kilowatts, had Steinmetz coefficients of 0.917 and 0.893 respectively; that is to say, the output of these modern machines is three times as much, in proportion to the material used, as the one first mentioned. These figures are based upon the armature performance only, but they depend, of course, to a considerable degree, upon the field construction, and it is likely that figures showing the economy effected in the design of this portion of the machine would be equally satisfactory.

A study of alternators by means of the same coefficient showed that the advance in the design of these machines has been even more striking. For example, a machine built in 1889, and rated at seventy-five kilowatts, had a Steinmetz coefficient of three. This was a single-phase machine, and for this reason it is hardly fair to compare it directly with the three-phase machines of to-day. However, a machine built a little later, and rated at 150 kilowatts, had a Steinmetz coefficient of 1.76. Another alternator mentioned by Dr. Thompson, with a rating of 350 kilowatts, had a coefficient of 2.8, although it was built in 1894. In 1896, however, this ratio had gone down to 1.73 for a 1,000-kilovolt-ampere generator, and for the most modern alternator mentioned in the paper under discussion, the coefficient was 0.64—a decrease to about one-fifth of the original value. This latter machine is one of the 4,000-kilowatt, three-phase generators in the Carville station.

True, in this way, the advance which has been made in the design of dynamos is certainly highly satisfactory. It might, of course, be said that the first machines were not really good ones, and hence there is not so much cause for congratulation. However, they did represent the best practice of their day, and only by careful attention to the details of design and to the selection of materials has it been possible to make the advance thus indicated. Nor does it seem that we have yet reached the limit in this respect. Continued improvement, and, possibly, the use of still higher speeds, may bring about further reductions in this coefficient; but it is not likely that any such relative reduction as has already taken place will be brought about. This, of course, is not to be expected.

A RADIOACTIVE DÉBUTANTE.

Since the discovery of radium by the Curies there have been a number of new members of the radioactive family which have been introduced to the scientific world. Some of these, such as uranium, were already well known, but their full character had not been understood; others, such as actinium and polonium, were really new elements which were only discovered through this new property of radioactivity. As active work, inspired by interest in the new phenomenon, went on, certain facts were observed which led to the belief that certain of these materials not only exhibited a family resemblance in some respects, but were actually related. Radium, for example, is believed to be a direct descendant of uranium, and itself to produce a vigorous progeny. Only in this way could a satisfactory explanation be offered for the fact that the content of radium in uranium minerals always bears a definite proportion to the amount of uranium. Naturally, attempts were made to prove directly the production of radium from uranium, but never with success, although what were supposed to be intermediate steps in the change of the uranium were observed.

Hope was not given up, however, and recently Mr. B. B. Boltwood made a more painstaking search, hoping to identify the missing link. And his efforts seem to have been rewarded at last by the separation of the sought-for element, as he recounts in the May issue of the *American Journal of Science*. The débutante of the radioactive family, strange as it may seem, is a progenitor and not a descendant of radium, the first new member introduced. To the newcomer its sponsor has given the euphonious name of "ionium." He says that in character it closely resembles thorium, though it has not yet been isolated in sufficient quantity for a more exact description of its personal attributes to be made. It is believed to be the direct parent of radium, into which it converts itself at the rate of half its mass in twenty-five years.

The radioactive group of elements is becoming a pretty large family, and all of them are very respectable elements—that is to say, their molecular weights are large. The study of them will probably have an important influence on the future of the physical and chemical sciences, and perhaps on other branches as well. No one as yet knows what may, or may not, be the effects of these interesting substances on the organic life of the universe.

The National Electric Light Association.

Thirty-first Convention, Auditorium, Chicago, Ill., May 19, 20, 21, 22.

THE thirty-first convention of the National Electric Light Association will be held at the Auditorium, Chicago, Ill., May 19, 20, 21 and 22. This year the list of papers is somewhat shorter than usual, and it is hoped that with more time at their disposal those in attendance at the technical sessions will indulge in a full discussion of the subjects presented. The three subjects of paramount importance, which will be given greatest attention in the papers presented, are Public Policy, affecting the relations of the company with its customers, the public, with the municipal and other authorities; Increasing Business, affecting the ways and means of promoting a greater use of electricity among all classes; Economy of Operation, affecting the engineering and administrative branches of the central station. The following programme has been announced:

TUESDAY, MAY 19, OPENING SESSION, TEN O'CLOCK.

President's address.

Announcements, by the secretary.

Report of Committee on Progress, T. Commerford Martin, New York.

Distribution in Suburban Districts, George H. Lukes, Chicago, Ill.

"Tape," Paul Lüpke, Trenton, N. J.

Report of Committee on Grounding Secondaries, W. H. Blood, Jr., chairman, Boston, Mass.

"Series Incandescent Lighting with Tungsten Lamps," P. D. Wagoner, Schenectady, N. Y.

AFTERNOON SESSION, TWO-THIRTY O'CLOCK.

"Observations on the Precision of Different Types of Photometer," Professor A. E. Kennelly and S. E. Whiting, Harvard University.

"Power Load Development for Central Stations of Moderate Size; Some Unappreciated Possibilities," Charles Robbins and J. R. Bibbins, Pittsburg, Pa.

"The Small Station and Its Economical Operation," J. T. Whittlesey, Newark, N. J.; Paul Spencer, Philadelphia, Pa.

Question Box, Alex. J. Campbell, editor, New London, Ct.

Report of Committee on Uniform Accounting, H. M. Edwards, chairman, New York city.

"Candle-Power Standard"—The presentation of resolutions toward the adoption of an international standard.

WEDNESDAY, MAY 20, MORNING SESSION, TEN O'CLOCK.

General Meeting.

Report of Committee on Gas Engines, W. C. L. Eglin, chairman, Philadelphia, Pa.

"Low-Pressure Steam Turbines," John W. Kirkland, Schenectady, N. Y.

Report of Committee on Meters, L. A. Ferguson, chairman, Chicago, Ill.

"Receiving Stations Operated from High-Tension Lines," S. Q. Hayes, Pittsburg, Pa.

Report of Committee on Organization Possibilities, Henry L. Doherty, New York city.

Special Meeting, banquet hall, sixth floor.

PARALLEL SESSION, TEN-FIFTEEN O'CLOCK.

Uniform Accounting and Its Details—Open to all accountants and others interested.

H. M. Edwards, chairman Committee on Uniform Accounting, will preside.

EVENING SESSION, EIGHT O'CLOCK.

Executive session.

Report of secretary and treasurer and executive committee.

Report of insurance expert, W. H. Blood, Jr., Boston, Mass.

Report of Committee on Public Policy, Arthur Williams, chairman, New York city.

"The Status and Commercial Possibilities of High-Efficiency Lamps," and discussion, W. W. Freeman, Brooklyn, N. Y.

Report of Committee on Rates and Costs, R. S. Hale, chairman, Boston, Mass.

Election of nominating committee.

THURSDAY, MAY 21—MORNING SESSION, TEN O'CLOCK—AFTERNOON SESSION, TWO-THIRTY O'CLOCK.

COMMERCIAL DAY.

C. W. Lee, chairman Programme Committee, New York city.

Henry L. Doherty, past-president, will preside during Commercial Day sessions.

1. Address—Relationship Between the Engineering and Commercial Departments, Louis A. Ferguson, past-president, Chicago, Ill.

2. Preparation for a Campaign:

(a) Field Work and Other Essentials.

(b) Analysis of Customers' Accounts.

(c) Proportion of Lamp Equivalent Lost to Lamps Connected—Showing Percentage in Cities of Varied Populations.

(d) Policy of Handling Complaints.

(e) Policy of Handling Collections.

Editor: H. J. Gille, Minneapolis, Minn.

3. The Contract Agent and the Representative:

(a) The Contract Agent—His Possibilities.

(b) The District Representative—His Possibilities.

(c) The Special Representative.

1—The Sign Expert.

2—The Power Expert.

3—The Woman Representative.

(d) Solicitors' Meetings — Their Objects.

Editor: V. A. Henderson, Memphis, Tenn.

4. The Display-Room:

(a) Appointments and Methods.

(b) Value of Special Demonstrations.

(c) Value of Electrical and Food-Show Exhibits.

Editor: L. D. Mathes, Dubuque, Iowa.

5. Advertising:

(a) What Is Being Done.

(b) Why?

(c) Results.

Editor: Charles A. Parker, Detroit, Mich.

6. Publicity:

(a) Methods to Create Proper Public Sentiment.

(b) Dormant Publicity Opportunities of Lighting Companies.

Editor: Percy Ingalls, Newark, N. J.

7. Creating Demand for Electricity:

(a) The Creative Principle.

(b) Notable Examples.

(c) Stereopticon Talk Upon Outline and Sign Lighting—Showing Progress in Large and Small Cities.

Editor: Frank B. Rae, Jr., New York city.

8. Evolution of New-Business Building:

(a) Examples of Central Stations That Have Continued Methods During Depression.

(b) Strong Plea for Upkeep of Commercial Departments and Advertising.

(c) Opportunities for Creating Business Along Existing Lines.

Editor: George N. Tidd, Scranton, Pa.

9. The Electrical Contractor:

Symposium:

(a) What He Is Doing to Assist in Creating Greater Demands for Electricity.

(b) Specific Examples.

Editor: Joseph F. Becker, Jr., Brooklyn, N. Y.

10. "Co-operative Commercialism," J. Robert Crouse, Cleveland, Ohio.

11. "Illuminating Engineering as a Commercial Factor"—Illustrated, V. R. Lansingh, New York city.

12. Report of Committee on Solicitors' Handbook Prize Award, John F. Gilchrist, chairman, Chicago, Ill.

13. Report of Committee on Co-operative Electrical Development, W. W. Freeman, chairman, Brooklyn, N. Y.

FRIDAY, MAY 22—MORNING SESSION, TEN O'CLOCK.

General Meeting.

"Illuminating Engineering," W. D'A. Ryan, West Lynn, Mass.

Report of Committee on Protection from Lightning and Other Static Disturbances, R. S. Stewart, chairman, Detroit, Mich.

"The Value of Care and Maintenance of Meters," H. D. King, Hoboken, N. J.

"Some Experiments in Combustion," S. J. Lenher, New York.

"Specifications for Construction on Joint Poles," Paul Spencer, Philadelphia, Pa.

Final Report of 1907 Committee to Consider Specifications for Street Lighting, W. D'A. Ryan, West Lynn, Mass.

Memorials, T. C. Martin, New York.
Executive session.
Election of officers for the ensuing year.

The Entertainment Committee has made arrangements to supplement the technical sessions, the entertainment to begin with the opening of the exhibition on Monday evening, followed by a reception and dancing. On Tuesday afternoon John T. McCutcheon will give a talk at the Art Institute on "The Philosophy of the Cartoon." For Tuesday evening a visit to White City is planned.

The ladies are especially invited to visit the establishment of Marshall Field & Company on Wednesday morning, and luncheon will be served at one o'clock. In the afternoon members and guests are invited to inspect the Fisk street turbine station of the Commonwealth Edison Company.

The ladies will be taken for an automobile drive Thursday morning through the South boulevards and parks, arriving at the South Shore Country Club at one o'clock, where they will be entertained at luncheon by the board of governors of the club.

In the evening a theatre party is arranged for members and ladies accompanying them.

The special train leaving New York, *via* the Pennsylvania at 9.55 Sunday morning, May 17, will carry a large party from the East, every berth of the seven-car train having been taken early in the week. Among those who will form the party are E. J. Allegaert, W. H. Allen, A. A. Anderson, A. D. Babson, C. O. Baker, J. F. Becker, Jr., T. H. Brady, John J. Burleigh, Alex. J. Campbell, A. Creelman, H. C. Cushing, F. L. Dame, Mrs. F. L. Dame, William A. Donkin, F. E. Donohoe, Mrs. F. E. Donohoe, M. M. Eckhardt, E. L. Elliott, Charles A. Flynn, H. W. Fuller, Mrs. H. W. Fuller, R. H. Garrison, Mrs. R. H. Garrison, E. B. Greene, Mrs. E. B. Greene, A. A. Gray, C. W. Hare, General George H. Harries, Percy Ingalls, E. J. Kiefer, J. B. Klumpp, C. A. Learned, E. F. McCabe, Mrs. E. F. McCabe, T. C. Martin, R. S. Orr, A. H. Patterson, C. A. Paul, Mrs. C. A. Paul, S. E. Phillips, Charles W. Price, James E. Pyle, George F. Porter, Frank B. Rae, Jr., H. Riddell, R. W. Rollins, M. S. Seelman, Jr., H. L. Shippy, L. E. Sinclair, F. W. Schmidt, Paul Spencer, E. S. Strunk, K. B. Thornton, Ward Thoron, J. M. Wakeman, S. C. Whitney, J. T. Whittlesey, F. W. Willcox, Elmer E. Wood, R. R. Young.

The Exhibition Committee announces a very complete presentation of apparatus and supplies which will be shown in the exhibition hall of the Auditorium. The decorations will present a beautiful, harmonious color scheme, which effect, it is expected, will be heightened by the lavish use of metal-filament incandescents in the decorative lighting. The following manufacturers will be among those represented:

The Allis-Chalmers Company, Milwaukee, Wis., will have an exhibit representing all of the standard power and electrical machinery which it manufactures, including every type of prime mover, generator, motor and auxiliary apparatus. The company's new line of type K motors for direct current, and type AN induction motors for alternating current will be particularly prominent. The exhibit will be in charge of C. A. Tupper, and a large number of the officers and salesmen of the company will be in attendance. These will include, probably, President W. H. Whiteside, W. S. Heger and M. C. Hiller, assistants to the president; A. H. Whiteside, manager of the steam and electrical department; E. T. Adams, manager of the mill and gas engine department; B. A. Behrend, chief electrical engineer; James Gardner, district manager of the company at Chicago; and S. R. Kerr, C. S. Buell, Ervin Dryer, J. M. Denniston, D. K. Chadbourne, H. I. Keen, A. W. Catlin, Charles M. Howe, O. F. Russell, T. B. Whitted, R. H. Gaither, C. M. McDonald, R. B. Williamson, L. E. Bogen, David Hall, B. Frankenfield, H. L. Watson, J. S. Jackson, J. S. Vrabek, D. H. Kelley, J. M. Kingsbury, W. G. Hammond, G. S. Burdick, R. D. Tomlinson, Percy A. Himes, D. P. Davies, L. C. Marburg, C. E. Lord, Willis Collins and C. A. Shearer, engineers and salesmen of the company.

The American District Steam Company, Lockport, N. Y., will exhibit all the details of the operation of both live and exhaust underground steam-heating systems. A large corps of engineers and representatives will be in attendance.

The Condit Electrical Manufacturing Company, Boston, Mass., will exhibit a complete line of Condit circuit-breakers. The exhibit will be in care of Taussig & Babcock, under the direct supervision of P. R. Fisher, western manager of the Condit company. F. W. Nason, of the New York offices; S. M. Keeble, of St. Louis, Mo., and S. B. Condit, Jr., general manager, will also attend.

The Crocker-Wheeler Company, Ampere, N. J., will exhibit a complete line of electric motors. The company will be represented by Rodman Gilder, William F. Sullivan, Hugh A. Brown, Herbert E. Kerber and R. J. Randolph, Jr.

Dossert & Company, New York city, manufacturers of solderless connectors, cable taps and terminal lugs for electric cables and solid wires, will exhibit a complete line, including a number of new devices for central station work, and connectors for heavy cables. The company will be represented by H. B. Logan, president, and Charles A. Flynn, mechanical engineer.

The Duncan Electric Manufacturing Company, Lafayette, Ind., will exhibit one of its total-output station integrating watt meters and one of its latest graphic recording instruments. The latter is claimed to be one of the most accurate and simple instruments in use. The two instruments are so combined that the totalizing meter not only integrates or adds up the total output of the station, but it also actuates the graphic recording instrument, which shows the output on a moving strip of paper. This will be the first public exhibition of a system whereby the output of any number of dynamos, irrespective of whether they are direct-current, or single or polyphase alternating-current, can be conveniently combined so as to show their total output on a single instrument. There will also be on exhibition a number of the latest Duncan house type and switchboard type meters. The exhibit will be in charge of Adrian Tobias, sales manager, and John A. Clark, laboratory expert.

The Electric Appliance Company, Chicago, Ill., will have reception headquarters at the exhibition adjoining the exhibit of the Sangamo Electric Company, for which it is general selling agent. The Sangamo company will make an exhibit of Sangamo integrating wattmeters. The company will be represented by P. R. Boole, general sales manager; F. J. Alderson, R. S. Mitten and F. D. Schwartz.

The Electric Service Supplies Company, Chicago, Ill., will exhibit a full line of Garton-Daniels lightning arresters for all classes of service; Locke high-tension porcelain insulators, including the latest design of suspended type for 100,000-volt lines; "G. & W." line devices, and many other articles which will be found of interest to the central station visitor. The company will be represented by J. W. Porter, first vice-president, and Messrs. Mason and Adams, of the sales organization.

The Federal Electric Company, Chicago, Ill., will make a complete exhibit of its

porcelain-enameled steel signs, tungsten clusters, couch brackets and other "boosters" for central station new-business departments. Central station men will find much of interest at the Federal booth. James M. Gilchrist, L. G. Shepard, H. I. Markham, F. H. Welling and S. C. Wachenfeld will be in attendance.

The Fort Wayne Electric Works, Fort Wayne, Ind., will exhibit a complete line of generators, motors, arc lamps and measuring instruments. The company will be represented by F. S. Hunting, sales manager and treasurer; A. A. Serva, assistant sales manager; T. J. Ryan, manager of the Cincinnati, Ohio, office; W. C. Knight, manager of the St. Louis, Mo., office; W. S. Goll, manager of the Chicago office.

The General Electric Company, Schenectady, N. Y., will exhibit a full line of heating devices, including the mantle type luminous radiator. There will be a prominent exhibit of tungsten lamps for both interior and outdoor lighting, and luminous and flame arc lamps. The new aluminum-cell lightning arrester, a line of portable and stationary meters, and alternating and direct-current motors for small power purposes, will be shown. An oscillograph will be in operation and records will be taken to show the effect of different values of reactance on wave form. The company will give a daily demonstration of electric cooking devices, and will distribute the electrically cooked dainties. Among the representatives of the company will be the following: E. W. Rice, Jr.; J. R. Lovejoy, C. D. Haskins, P. D. Wagoner, F. G. Vaughen, D. R. Bullen, E. E. Gilbert, W. L. R. Emmet, C. W. Stone, N. R. Birge, C. B. Burleigh, C. P. Steinmetz, J. W. Kirkland, Theodore Beran, A. D. Babson, H. J. Buddy, A. D. Page, T. E. Bibbins, F. H. Gale, G. L. Thompson, D. B. Rushmore, F. W. Willcox.

G. M. Gest, New York city, will make an exhibit of conduits, underground construction, fittings, and a display of photographs showing conduit construction in all sections of the country. The exhibit will be in charge of W. T. Jackson, Cincinnati representative, assisted by J. A. Doyle, and superintendents of construction from the Middle West.

The Gregory Electric Company, Chicago, Ill., will establish reception headquarters and probably exhibit a line of "Century" single-phase motors. The company will be represented by A. L. Kuehnsted, president and general manager; A. O. Kuehnsted, vice-president; J. D. Zook, general superintendent; G. C. Besold, secretary; E. H. Nagelstock, R. H. Russell and J. S. Vincent.

The H. W. Johns-Manville Company, New York city, will have a particularly attractive exhibit. The new "Linolite" system of lighting will be used for outlining, and will demonstrate the special advantages of this form of lighting. The "Linolite" system consists of a system of tubular electric lamps, each one foot between centres, with a filament extending from one end to the other, and the lamps placed in the focus of a powerful aluminum reflector. Several new forms of "Linolite" lamps will be shown with parabolic reflectors for desk and picture lighting, signs, etc. There will also be shown a large line of "Victor" portable and switchboard instruments, including a portable lamp-testing meter. This indicates the voltage, current consumed and wattage at a glance. A switchboard and sample board will also be shown, made of ebony asbestos wood. Several new forms of "Noarc" fuse devices, including service and subway boxes of the latest type, will be shown. The company will be represented by J. W. Perry, manager of the electrical department, New York; H. M. Frantz, manager of the electrical department, Chicago; G. A. Saylor, manager of the electrical department, Milwaukee; T. J. Younglove, manager of the Chicago office; F. G. Frumveller, of the Chicago office; E. B. Hatch, president of the Johns-Pratt Company, Hartford, Ct.

The William D. McJunkin Advertising Agency, Chicago, Ill., will exhibit advertising material for central stations, including specimens of newspaper advertising, outdoor posters, street-car cards in colors, etc., material which the company has used during the past year for clients in Chicago, Cleveland and Buffalo. William D. McJunkin and John Benson will represent the company.

The Minerallac Company, Chicago, Ill., will exhibit Minerallac No. 1 and Minerallac No. 2 insulating compounds for making joints in underground high-tension cables. The company's soft-finish "Linotape," for use in connection with these insulating compounds, will be exhibited. A line of electrical specialties, such as the quick-action voltmeter switch and cable hangers, will be shown. The company will represent the Chicago Electric Meter Company, which is putting on the market an automatic printing attachment for power wattmeters. The purpose of this attachment is to give a printed record of the power consumed at intervals of from one-quarter of an hour to one hour, as may be desired, this record being printed in numerals on a receiving tape. The Murray-loop testing set which has been developed for central station use will also be shown. The exhibit will be in charge of R. F. Pierce, manager of the Minerallac Company.

The National Electric Lamp Association, Cleveland, Ohio, will arrange a very complete exhibit through its engineering department, occupying a large space in the centre row of exhibits. The feature of the display will be festoons of tungsten and tantalum lamps equipped with proper reflectors. Miniature lamps with carbon, tantalum and tungsten filaments will be used in the decorations. The booth will be decorated also with plants of various kinds, and will serve to demonstrate the advantages of the newer forms of incandescent lamps. S. E. Doane, chief engineer of the association, and the various officials of the companies comprising the association will be in attendance. The exhibit will be in charge of Messrs. Norris, Bauder and Fisher, of the engineering department.

The Pettingell-Andrews Company, Boston, Mass., will show its regular line of specialties and some recent productions of its fixture factory. The meter connection block and "O. K." fuse block cover should be of particular interest to central station men. Some interesting adaptations of remote-control switches will also be shown. The company will be represented by F. S. Price, secretary; W. J. Keenan, sales manager, and G. E. Palmer, electrical engineer.

The Pittsburgh Transformer Company, Pittsburg, Pa., will exhibit a line of representative standard transformers, showing its new line built with vanadium silicon steel. These transformers exhibit a performance which is said to be a sensational advance in the art of transformer building. The exhibit will also include transformers in small units for use at any point along a high-tension transmission line. The company will distribute its "Pretty Girl" calendars in conjunction with a "Little Pittsburg Smoke" in the shape of its Pittsburg stogie. The following representatives will be in attendance: H. J. Steele, R. V. Bingay, F. C. Sutter and C. R. Lininger.

The Philadelphia Electrical and Manufacturing Company, Philadelphia, Pa., will exhibit its line of incandescent street-lighting fixtures, especially new fixtures for tungsten lighting, as well as fuse boxes, absolute cutouts, and a general line of supplies. There will also be presented a new

compound which the company has put on the market, known as "Antirust." This is used to prevent rusting and corroding of iron. The company will be represented by C. L. Bundy, secretary and treasurer, and R. H. Manwaring, salesman.

The Sangamo Electric Company, Springfield, Ill., will exhibit direct-current and alternating-current wattmeters of switchboard and regular types, and will make a particular display for the first time of its new type "F" alternating-current meter, which is a mercury motor meter having a remarkably high torque and some new features of mechanical and electrical construction. Jacob Bunn, president, and a corps of representatives will be in attendance.

The Simplex Electric Heating Company, Cambridge, Mass., will exhibit a line of electric heating and cooking apparatus, and will be represented by H. R. Hixson, E. R. Jacobs, J. N. Macalister, James I. Ayer and Roger Williams.

The Triumph Electric Company, Cincinnati, Ohio, will exhibit some of its induction motors and transformer starters. There will also be shown a specially designed switch for use in induction motors. The company will be represented by W. H. Jacob, C. S. Reno, chief engineer; S. Sentius, Edward S. Ford, of the Cleveland office; F. L. Merrill, of the Chicago office, and possibly J. C. Hubbard, secretary and manager, and F. B. Thompson, of the St. Paul office.

The Wagner Electric Manufacturing Company, St. Louis, Mo., will exhibit a five-horse-power, single-phase motor of the latest design, a ten-horse-power polyphase motor, and a set of standard Wagner instruments. A feature of this exhibit will be the demonstration of the large material allowance and ample weight of the ten-horse-power polyphase motor exhibited by this company. Attention is called to the excellent finish of the Wegner apparatus. The company will be represented by W. A. Layman, vice-president and general manager; W. Robbins, assistant general manager; V. W. Bergenthal, assistant manager of sales; Thomas T. Richards, advertising manager; E. W. Goldschmidt, district manager New York office; F. N. Jewett, district manager Chicago office; John Mustard, district manager Philadelphia office; A. W. Wyckoff, district manager Pittsburg office; Dean Emerson, district manager Cincinnati office; A. H. Mustard, district manager Atlanta office; F. Johnson, district manager St. Louis office.

The Western Electric Company, Chicago, Ill., will exhibit a line of arc lamps, fan motors, power apparatus and electrical supplies. The exhibit will be in charge of H. M. Post, and the following branch office managers will be in attendance: R. M. Morris, Pittsburg; T. R. Slater, Minneapolis; J. A. Pizzini and R. Edwards, Jr., New York; O. W. Visscher, Philadelphia; T. A. Burke, Atlanta; L. T. Milnor and W. S. Berry, Cincinnati; C. D. Wilkinson, St. Paul; C. H. Talmage, Kansas City; R. Spencer, Los Angeles; E. H. Peterson and P. A. Morse, St. Louis, and E. W. Rockafellow, sales manager, New York.

The Westinghouse Electric and Manufacturing Company, Pittsburg, Pa., will exhibit some of its detail apparatus, such as switches, circuit-breakers, motors, lightning arresters, arc lamps, wattmeters, voltmeters, ammeters, graphic recording meters, etc. A fine line of electric heating devices, including an electric goose or tailor's iron, electric sad-irons, matrix driers, bookbinder's tools, etc., will also be shown. The Westinghouse Lamp Company, Pittsburg, Pa., will exhibit a full line of its lamps, including tungsten lamps. The following representatives will be in attendance: Westinghouse Electric and Manufacturing Company—C. S. Cook, manager railway and lighting sales department; S. L. Nicholson, manager industrial and power sales department; C. B. Humphrey, manager detail and supply sales department; T. P. Gaylord, manager Chicago office; E. T. Penrose, Philadelphia office; W. B. Wilkinson, Pittsburg office; Charles Robbins, industrial and power department; G. B. Griffin, assistant manager detail and supply sales department; W. P. Jend, Pittsburg office; G. M. Bates, Boston office; G. E. Miller, manager Cleveland office; J. A. Bratt, manager Cincinnati office; C. F. Medbury, manager Detroit office; Samuel Chase, New York office. Westinghouse Machine Company: C. C. Chapelle, manager Chicago office. Westinghouse Companies' Publishing Department: J. C. McQuiston, manager.

Among other exhibitors will be the ELECTRICAL REVIEW, *Electrical World*, *Western Electrician*, *Illuminating Engineer*, *Electrical Record*, German-American Electric Company and the C. W. Lee Company, who will publish the "Convention Daily", and the Central Electric Company, Chicago, Ill.

Interborough's Right to Claim Exemption from Special Franchise Taxation Upheld.

The Interborough Rapid Transit Company's right to claim exemption from taxation for a special franchise was upheld by the Appellate Division of the Supreme Court of New York state, at Albany, N. Y., on May 6. The company appealed from the action of the state tax commission in assessing its special franchise for 1905 at $9,000,000. The appeal was based on the ground that the company was exempt from special franchise taxation under the rapid transit act, under which the New York subways were built, it having taken over the property and rights of the contractor, John B. McDonald.

Conference on the Conservation of Natural Resources.

A conference of the governors of the different states was held at the White House, Washington, D. C., on Wednesday, Thursday and Friday of this week to consider ways and means of conserving the natural resources of the country. The following was the preliminary programme arranged for the meeting:

May 13, 11 A. M.—"Conservation as a National Duty," Theodore Roosevelt, President of the United States. 2.30 P. M.—Mineral Resources: "Ores and Related Minerals," Andrew Carnegie; "Mineral Fuels," Dr. I. C. White, state geologist of West Virginia; general discussion, opened by John Mitchell.

May 14, 10 A. M.—Land Resources: "Soil," Professor T. C. Chamberlin, University of Chicago; geologist, United States Geological Survey, president American Association for the Advancement of Science; "Forests," R. A. Long, president Long-Bell Lumber Company, Kansas City, Mo.; "Public Health," Dr. George M. Kober, dean of the medical department of Georgetown University. 2.30 P. M.—Land Resources: "Reclamation by Irrigation and Drainage," Dr. George C. Pardee, ex-governor of California; "Grazing and Stock Raising," Hon. H. A. Jastro, president American National Live Stock Association; "The Public Lands and Land Tenure," Judge Joseph M. Carey.

May 15, 10 A. M.—Water Resources: "Transportation," James J. Hill, president Great Northern Railway; "Navigation," Professor Emory R. Johnson, professor of transportation and commerce, University of Pennsylvania; "Water-Power," H. S. Putnam, member American Institute of Electrical Engineers. 2.30 P. M.—General discussion.

In addition to the executives of the states about seventy scientific, industrial and engineering associations have been asked to take part in the conference.

Annual Meeting of the American Institute of Electrical Engineers.

The annual meeting of the American Institute of Electrical Engineers will be held in the Engineering Societies Building, New York city, on May 19, at 8 P. M. The board of directors will present its annual report, and the result of the election of officers will be announced. Two papers will be read, as follows: "Comparative Tests of Lightning Protection Devices on the Taylor's Falls Transmission System," by J. F. Vaughan, and "Studies in Lightning Performance. Season of 1907," by N. J. Neall.

The Commonwealth Edison Company.

The Magnificent System Supplying Chicago and Its Environs as It Is To-day.

WHEN the National Electric Light Association meets in Chicago next week a decided change will be found in the central-station system of that city since its last Chicago convention, five years ago. At that time the splendid Fisk street station, the pioneer mammoth turbo-generator station and the most interesting power plant in the world, was just rising into form. The members of the 1903 convention saw the iron framework which was to house the boilers and turbo-generator of the first unit. To-day they will see there a giant power station with ten units, the last six of which have a maximum capacity which is far in excess of twice the original rating of the first unit. And not only this, but they will see across the river the massive steel framework of another station, a brother giant of Fisk street, which, when completed, will contain six units, the first of which will have a maximum continuous capacity of 14,000 kilowatts. The other five will be no smaller.

This all denotes a very healthy growth of a progressive industry in a progressive community. It means that the central station company has more than kept pace with a rapidly growing industrial metropolis. The connected load at the beginning of this year, expressed in sixteen-candle-power lamp equivalents, was 4,720,000 or 236,000 kilowatts (about 316,000 horsepower). Ten years ago the connected load amounted to 600,000 sixteen-candle-power equivalents and five years ago to about 1,500,000. Prominent among the factors contributing to this is the policy of the company toward the public, which has always been one of fair dealing and liberality. The price for electrical energy has been voluntarily reduced a number of times, the total reduction in ten years being fifty per cent, and further reductions are already scheduled. The contract department wages a constant and active campaign of business getting, and by means of a monthly magazine liberally distributed, and by extensive newspaper and street-car advertising, the many new devices, both industrial and domestic, which use electrical energy, are made known to the public.

The disposal of current at wholesale to the various elevated and surface railway companies was begun six years ago with the Chicago & Oak Park Elevated Railway Company as the first customer. This class of business has developed rapidly until now about one-half of the entire output

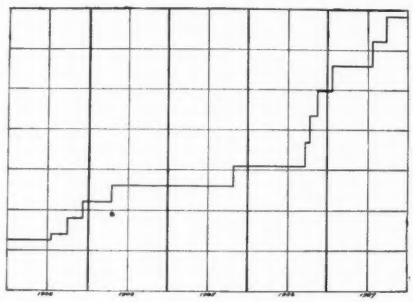


FIG. 1.—CURVE OF INCREASE IN GENERATOR CAPACITY.

is so sold, all of the traction companies, with but one exception, buying either all or a large part of their power from the

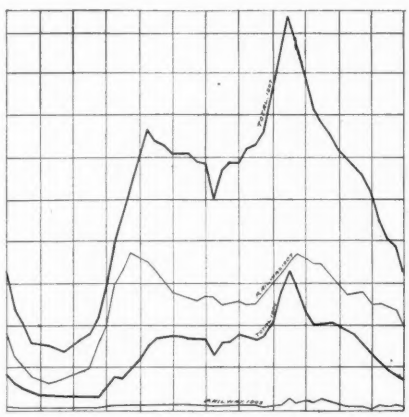


FIG. 2.—TYPICAL WINTER-DAY LOAD CURVE.

central station company. This power is metered at the station switchboard and transmitted over the company's high-ten-

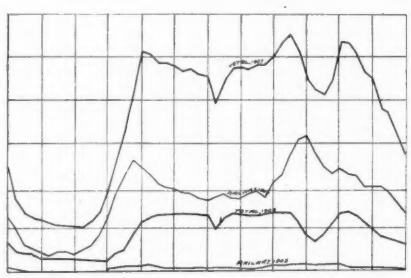


FIG. 3.—TYPICAL SUMMER-DAY LOAD CURVE.

sion lines to rotary converter substations, owned and operated by the railway companies.

The suburban lighting and railway field is also being developed for the wholesale supply of power. In this field (which is pretty well covered by a friendly corporation, the North Shore Electric Company) this suburban company is the purchaser, and it in turn distributes, supplementing its own plant, and sells part of the energy to the railways.

The curves of Figs. 1, 2 and 3 show graphically the increase in generator capacity and in load since 1903. Fig. 1 traces each new unit as it was put into service. The load curves of Figs. 2 and 3 show the change in the character of the curve since the railway load became a large item. The average daily load-factor at the present time is between sixty-five and seventy per cent. The yearly load-factor is, of course, less.

Up to September 17 of last year the central station business of Chicago was carried on by two allied companies, but on that date they were consolidated and now continue under the name combined of those of the original companies, namely Commonwealth Edison Company.

As explained in our issue of January 11, all of the output is at present generated in two principal stations, Harrison street, with a capacity of 18,000 kilowatts in engine driven units, and Fisk street, with a present capacity of about 100,000 kilowatts in alternating-current turbo-generators. A third station is being erected at Quarry street, across the river from Fisk street. This station is designed for an ultimate capacity of 84,000 kilowatts and six 9,000 volt turbine units. The first of these units is expected to be in service in the early autumn of this year.

All of the alternating-current generators are "Y" wound, the delta pressure being 9,000 volts, the frequency twenty-five cycles. The neutral of the generator is grounded and the transmission to sub-stations is effected by means of three-conductor underground cables mainly of 4/0 size. The total length of these cables is approximately 270 miles. The substations are connected on the radial plan, each important substation having one or more high-tension lines direct to a generating station. The total number of such transmission lines at present is sixty-six and there are seventeen lines more which connect between substations for use in emergencies or for feeding substations in tandem. A general idea of the component parts of the system can be obtained fro

Fig. 4, while Fig. 5 shows the transmission system. For greater reliability the entire system is operated divided into two independent sections, one being fed by Harrison street and part of Fisk, and the other by the balance of Fisk street. Shortly after the Quarry street station is in operation another division will be made, so there will then be three sections. A beginning has also been made in a higher voltage of transmission and the first 20,000-volt twenty-five-cycle line to the suburban district has been in service for nearly a year. For the present this pressure is obtained by step-up transformers located in one of the rotary converter substations.

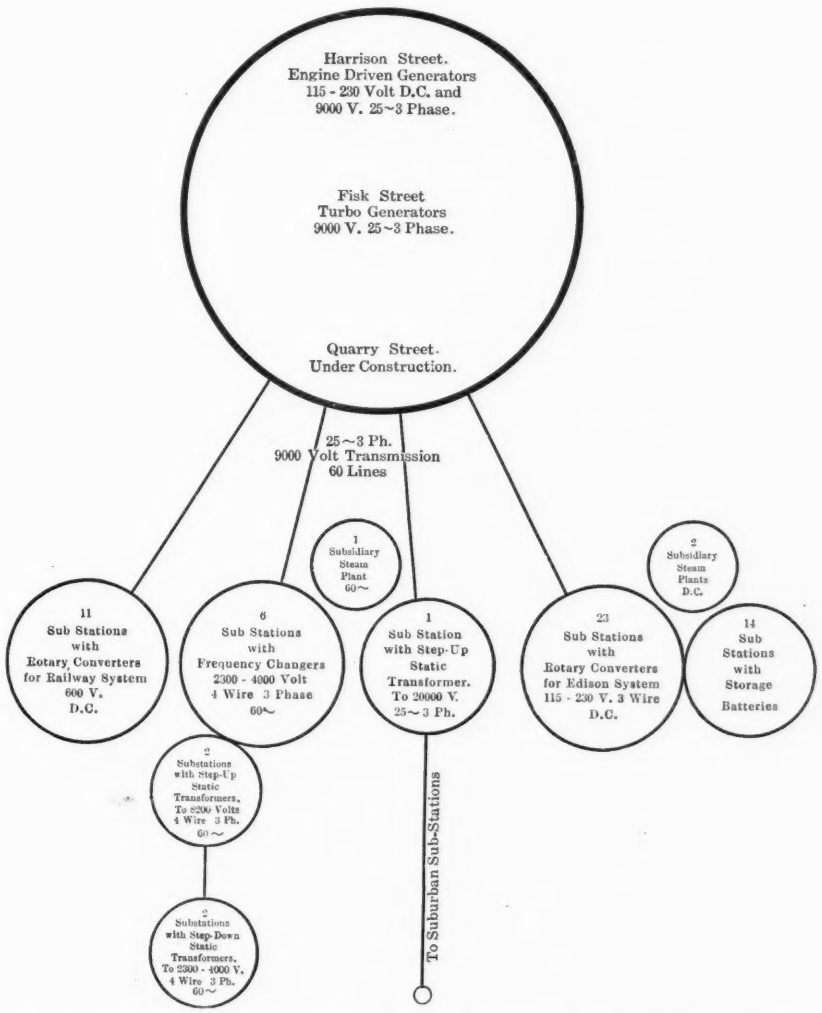


FIG. 4.—COMPONENT PARTS OF THE SYSTEM OF THE COMMONWEALTH EDISON COMPANY.

Of the main generating stations, Harrison street is the oldest. This was built in 1892 and was originally a low-tension station. At the present time it has four 9,000-volt alternating-current generators, the largest of which is of 3,500-kilowatt normal capacity. There is a 2,500-kilowatt double-current generator for direct-current or alternating-current service and six of the early 800-kilowatt two-generator engines. All of these units are driven by reciprocating engines. The station now has also two 550-kilowatt rotary converters, which were formerly double-current generators and can still be so used, and a 2,000-kilowatt converter. There are nine 9,000-volt lines leaving this station and three tie lines to the Fisk street station.

At the Fisk street station, as already noted, there are now ten units. The first four, originally rated at 5,000 kilowatts, are guaranteed for a 7,500-kilowatt, two-hour load, while the last six are for 12,000 kilowatts, two hours. There are eight boilers per unit arranged in a row at right angles to the turbine room. At the far side of the boiler house and part of the main building is the train shed, where coal is unloaded directly from the cars into receiving hoppers beneath the track. A McCaslin conveyer carries this coal and deposits it in the bunkers over the boilers. The same conveyer carries the ashes from beneath the boiler to the hopper above the tracks in the train shed. The bunker capacity per unit of eight boilers is 1,000 tons. The boilers are of Babcock & Wilcox manufacture and are provided with chain grates driven by electric motors with small steam-engine reserves. These can be seen in Fig. 6, which shows the fronts of the boilers of two units. The steam is generated at a pressure of 185 pounds and superheated 150 to 200 degrees Fahrenheit. Each two units, or sixteen boilers, have one stack. These stacks have a diameter of over twenty feet, are of steel and brick lined. The height of the first two is 205 feet, and of the others, for the larger units, is 260 feet above the boiler-room floor. The boilers are placed back to back in pairs of units and the header room, containing the steam, feed-water and blow-off header, is directly underneath. The service water pipes are also located in this lower space. The boiler feed-pumps for cold or hot feed are in the turbine room adjacent to the condenser of each unit, where the turbine operator has ready access to them. The piping of each unit is entirely independent with the exception of a cross connection of the main header and of the hot feed between adjacent units in pairs. The welded steel flanges on the wrought-iron header piping have ground surfaces.

As the steam efficiency of the turbines is markedly improved by a high vacuum, a very effective condenser and auxiliary equipment was advisable. The surface condenser is the most satisfactory type for these requirements. On the first four units an Alberger condenser with 20,000 square feet of condensing surface is used, the entire apparatus being placed adjacent to the turbine. On the larger units the condenser is placed within the turbine base, thus raising the turbine higher from the floor. These latter condensers are of the Worthington type and have 25,000 square feet of condensing surface. Condensing water is obtained through tunnels from the Chicago River and is circulated by individual centrifugal pumps driven by Corliss engines. The "dry vacuum" pump is driven from the same source while the hot-well pump of the larger units is driven by a vertical electric motor. Each unit has an individual oil-pressure pump for its step bearing and in addition accumulators are provided, one for each two units, for additional reliability. On the first four units

the individual pumps are motor-driven and the accumulator pumps steam-driven. On the six larger units this is reversed, the individual pumps being steam-driven and the accumulator motor-driven. These auxiliaries are clearly seen in Fig. 7, which shows one of the 12,000-kilowatt units. The turbine of these units has five stages and the speed is 750 revolutions per minute. The governor controls the separate steam valves by means of hydraulic pressure. On the original units this con-

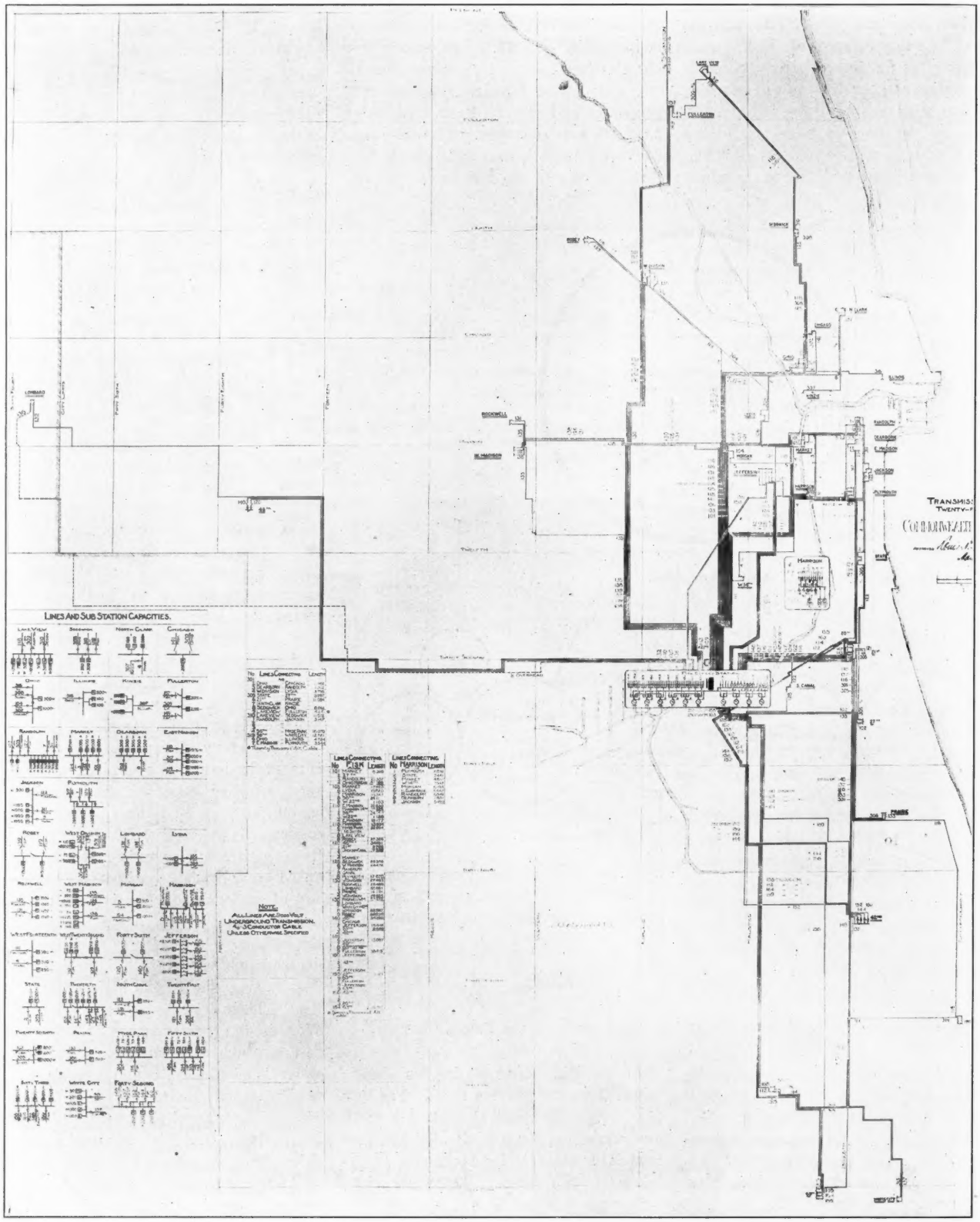

LINES AND SUB STATION CAPACITIES.
NOTE
ALL LINES ARE 2300 VOLT UNDERGROUND TRANSMISSION. 4-3 CONDUCTOR CABLE UNLESS OTHERWISE SPECIFIED

FIG. 5.—NINE-THOUSAND-VOLT TRANSMISSION SYSTEM OF THE COMMONWEALTH EDISON COMPANY, CHICAGO, ILL.

trol is effected electrically by means of solenoids at the valves. The fields of the 12,000-kilowatt units have four poles and through brass pipes, then under the floor, the field leads connecting with the excitation system in the turbine room and the tion motor-driven exciters of fifty, seventy-five and 150-kilowatt capacity and three seventy-five-kilowatt steam-driven excit-

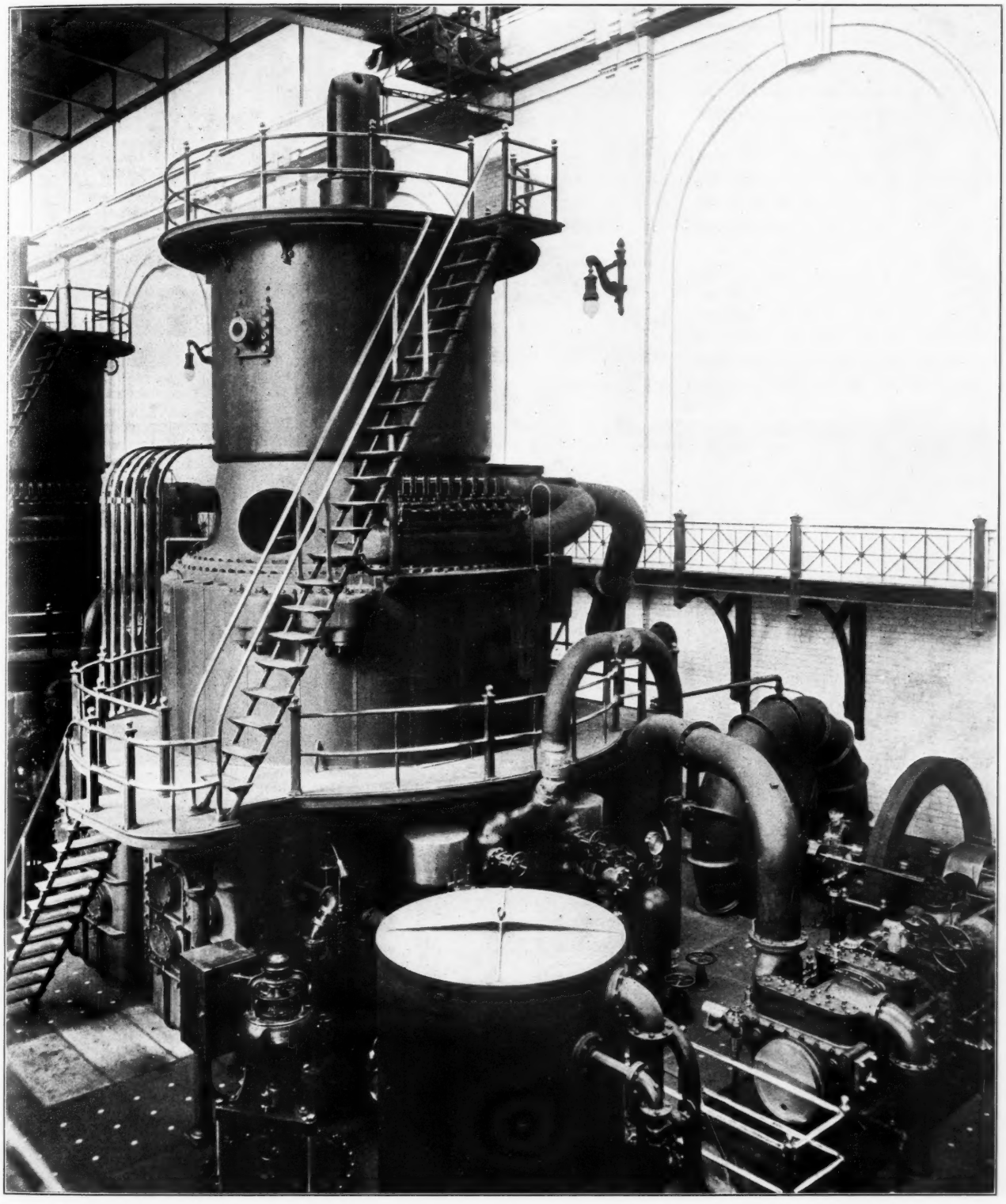


FIG. 7.—ONE OF THE MOST MODERN POWER PRODUCERS IN THE WORLD. TWELVE THOUSAND KILOWATTS, FISK STREET STATION.

the current is generated at 9,000 volts, three-phase, twenty-five cycles. The armature and field leads pass from the generator armature leads going to the generator oil-switches in the switch house. For the ten units now installed there are seven induc- ers. Two of these are driven by horizontal turbines. Three storage batteries, each of eighty-one kilowatts capacity at the one-

hour rate of discharge are kept "floating" on the excitation system at all times.

The 7,500-kilowatt units have four transmission lines each connected to their buses, while the 12,000-kilowatt units have eight each. These units and buses are operated in parallel, the entire station being divided into two independent sections. The switching arrangements are fairly flexible, so that most of the units can operate on either system and other desirable switching combinations can be obtained. The bus-bars are thoroughly protected by barriers and the entire construction is such as to obtain the highest degree of reliability. A row of line switches is shown in Fig. 8.

In the operation of the station and the maintenance of the property a force of nearly 300 employés is required, working in three shifts. Special attention has been given to providing suitable quarters, locker rooms, shower bath, reading room, etc., for these men. An electrical kitchen with a large electrical refrigerator is maintained, and meals are served daily. The dining room, kitchen, reading room and executive offices of the station are located on the second floor of the switch house. Fig. 9 is a view of the dining room, with the kitchen in the extreme rear, and Fig. 10 shows the reading room. A general view of the station, as it will appear when completed for fourteen units, is given in Fig. 11. On page 67 of the issue of January 11 we showed the interior of the turbine room with the row of ten units.

In the Quarry street station, now being erected just across the river (see Fig. 12), the available real estate necessitated an arrangement of boilers different from that of Fisk street. They will here be arranged in two rows paralleling the turbine room, though there will still be eight boilers per turbine. These boilers will have the same heating surface as the Fisk street boilers,

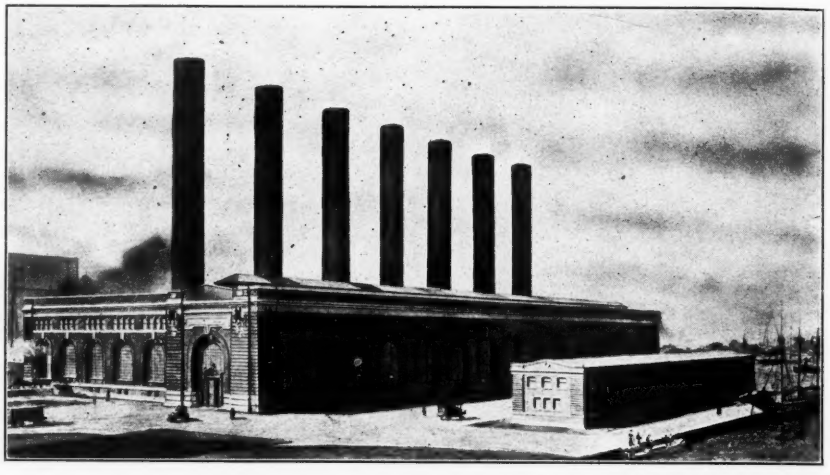


FIG. 11.—FISK STREET COMPLETED (ARCHITECTS' DRAWING.)

FIG. 6.—FISK STREET BOILERS, UNITS 2 AND 3.

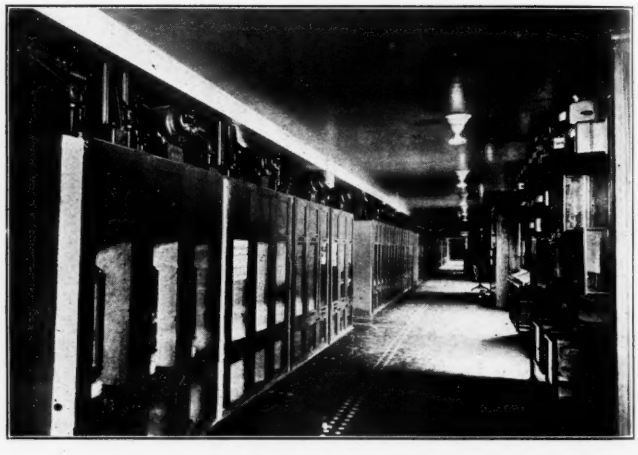


FIG. 8.—SWITCH-HOUSE INTERIOR, UNITS 5 TO 10.

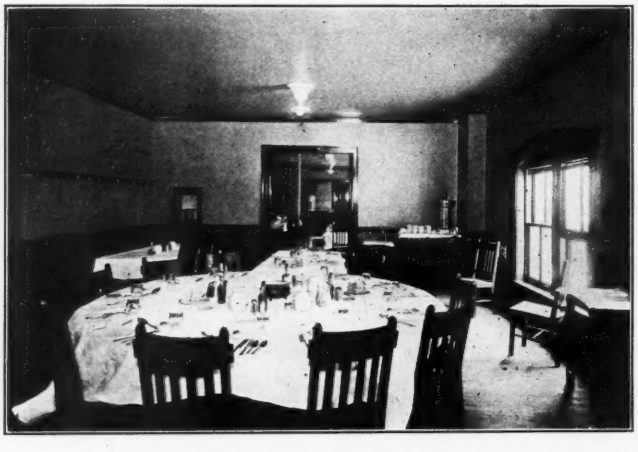


FIG. 9.—FISK STREET DINING ROOM.

FIG. 10.—FISK STREET READING ROOM.

namely, 5,000 square feet each, but will have vertical water legs because of the more limited boiler room space. The furnace will be somewhat different also, being under the low end of the tubes at Quarry street unit of 1908, both receiving their steam from boilers having the same heating surface.

The plans call for six units ultimately, with a capacity of 14,000 kilowatts each.

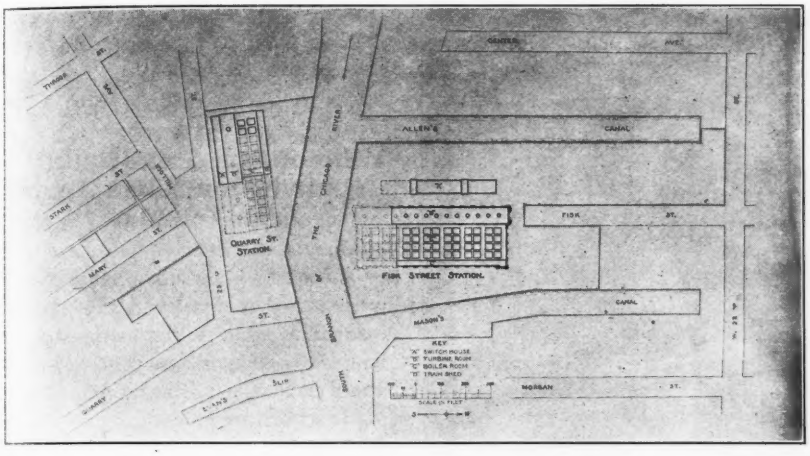


FIG. 12.—PLOT OF PROPERTY, FISK AND QUARRY.

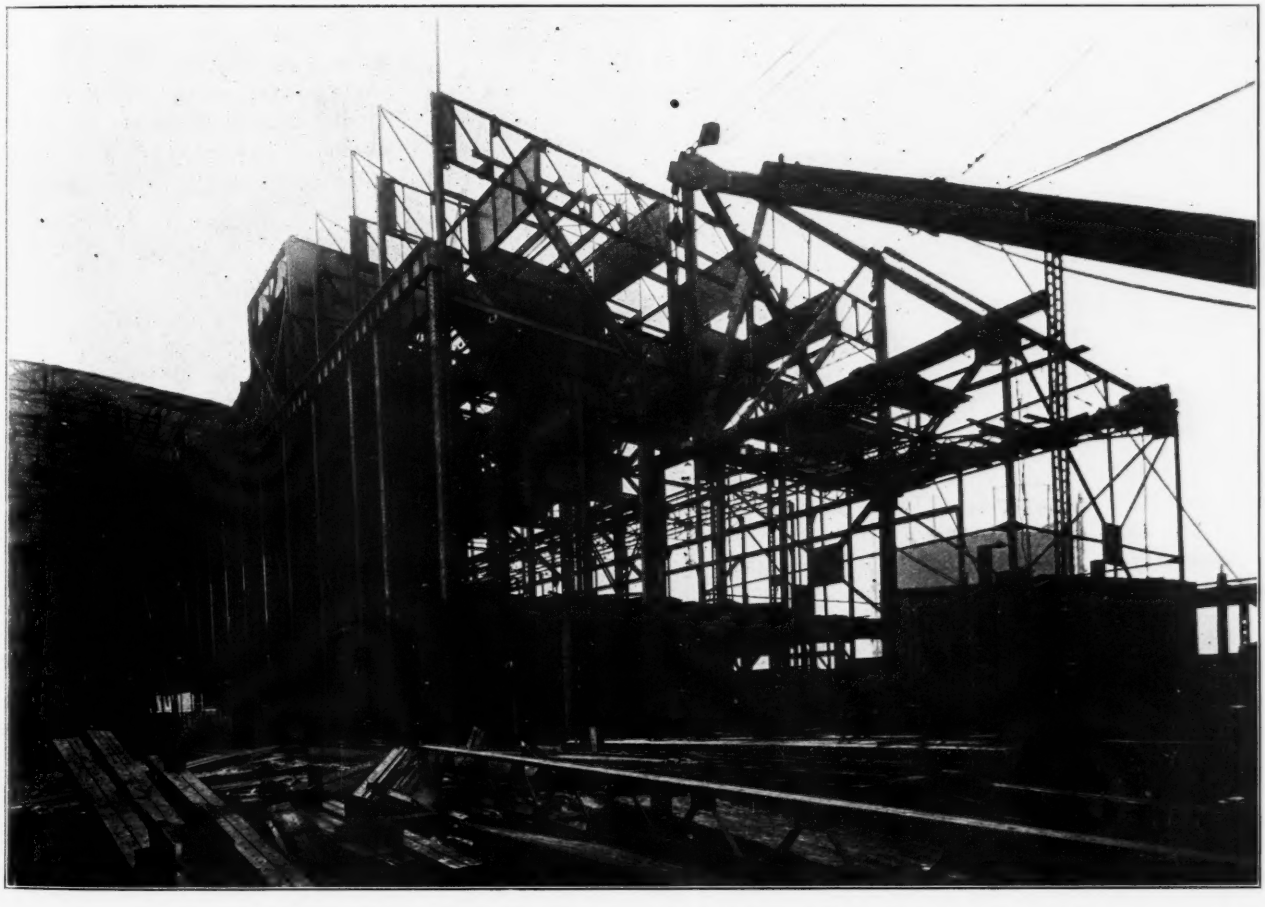


FIG. 13.—STRUCTURAL WORK, QUARRY STREET STATION, COMMONWEALTH EDISON COMPANY, CHICAGO, ILL.

The first of these will be wound for 9,000 volts, the same as the Fisk street units. The arrangement and construction of bus-bars will be practically the same as at Fisk street, with a few minor changes. A 150-kilowatt turbo-driven exciter will be installed to furnish excitation for the first two units. A storage battery will be added later. In the southwest corner of the building a substation will be located for converting to direct current, which will be used for various purposes in the station and surrounding territory and also for excitation reserve. The first unit to be installed will be a 500-kilowatt split-pole rotary on which the means for regulation are self-contained, thus requiring no separate regulator. This unit is the first one of its kind ever built.

The switch house differs from the one at Fisk street, in that it is part of the station structure and not a separate building. A heavy fire wall separates it from the turbine room. The operating galleries at Fisk street are in the turbine room. At Quarry street the operating room will be above the oil switch floor of the switch house, a bay extending slightly into the turbine room and provided with glass panels from the floor of operating room to its ceiling, affording an excellent view of the entire turbine room. An improvement in the switchboard consists in the

street, that is, the boiler has been turned end for end. The remarkable improvement in turbine design is clearly indicated by a comparison of the sizes of the original Fisk street unit of 1903 and the Quarry

entire separation of the line meter and control switch panels from the generator meter panels and control switch benches. Fig. 13 shows the Quarry street structure as it was on May 8.

The substations of the Commonwealth Edison Company are thirty-two in number. Of these twenty-three contain rotary converters which range in size from 100 kilowatts to 2,000 kilowatts, their total normal capacity being 51,700 kilowatts. The newest of these are vertical-shaft machines, which afford a considerable saving in weight and floor space. The shaft of this unit is really a stationary pedestal upon which the armature is hung. The bearings at the top are of the roller type. There are fourteen storage battery substations in all, of which eleven are in rotary-converter substations and three contain batteries only. The total capacity at the one-hour rate of discharge is 18,000 kilowatts. The manner of connecting the direct-current feeders to the switchboard can be seen in Fig. 14, which shows the rear of a rotary converter substation switchboard. The negative feeders connect with their switches at the lower panels, while the positive connect to copper bars at the wall, which bars in turn connect with the positive switches on the middle panel. All meters are on the upper slab. The horizontal bus-bars, which are a feature of the substations built during the last five years, are also shown in this figure. Two of the rotary converter substations on the border line of the direct-current district contain also frequency-changers. In addition there are four more frequency-changer substations, making six in all. Their aggregate rated capacity is 22,000 kilowatts. The size of these uni ranges from 500 kilowatts to 2,000 kilowatts, the latter of which are of the vertical shaft type (Fig. 15). There are at present five of these 2,000-kilowatt frequency-changers in service and two more will be installed this summer. The weight of the revolving part is maintained by oil pressure on a step bearing similar to the turbo-generators. One of the new units will be provided with roller bearings similar to the vertical rotaries. Sixty-cycle current is distributed from these substations on the four-wire three-phase system, the pressure being 2,300 volts, Y. In two of these substations the voltage is stepped up for transmission to distant sections and there again stepped down to 2,300 volts and distributed on the overhead system.

A total of 52,400 kilowatts rated capacity is installed in fourteen substations of the railway companies. Rotaries in these substations convert the current to 600 volts direct current. The rated capacity of the present 20,000-volt service for suburban use is 4,000 kilowatts in step-up transformers, made up of three 500-kilowatt single-phase transformers in parallel

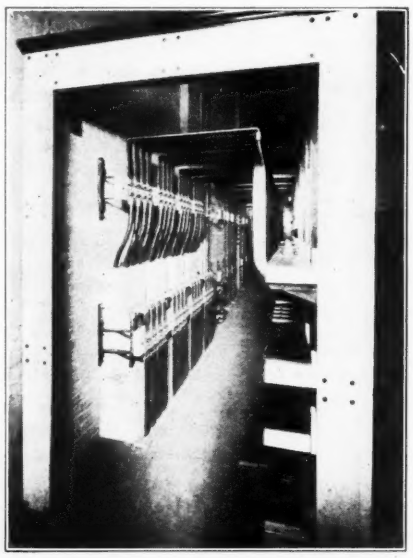


Fig. 14.—White City. Rear of Switchboard.

with a 2,500-kilowatt three-phase transformer.

This in brief describes the principal parts of the Commonwealth Edison Company's system as it is to-day. What another five years will bring none can tell. Will the sixth unit at Quarry street be

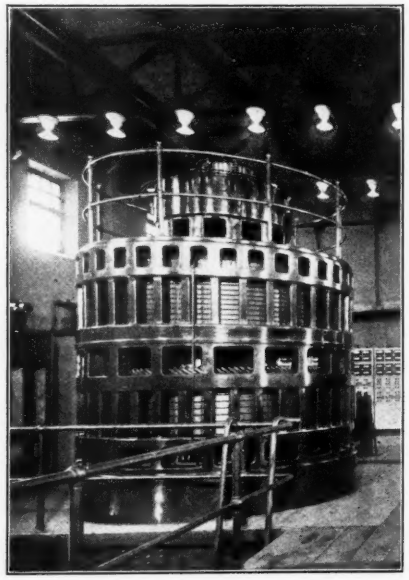


Fig. 15.—Hyde Park, 2,000-Kilowatt Vertical Motor-Generator.

only of 14,000-kilowatt capacity or will the advance in the turbine building art, and in boiler and furnace performances, enable one of 20,000 kilowatts, or even more, to be used in its stead, as the 12,000-kilowatt units are now being used at Fisk street, where 5,000 kilowatts was planned? And the substations, will there be a paltry forty or more of these, or will they be as plentiful as the corner cigar stores? Perhaps such apparatus as rotaries and frequency changers will be but history. The advances and revolutionizing discoveries have come rapidly in this industry and the imagination is unequal to the task of prophesying even its near future.

Wisconsin Public Utilities Commission Rules Against Free Telephones.

All free and reduced telephone service in Wisconsin is strictly prohibited by an order issued on April 28 by the state railroad commission, acting as the state public utilities commission. This and a dozen other important rulings respecting telephone service are promulgated by the order and as a result the 200 telephone companies operating in Wisconsin will have to readjust their schedule of rates and methods of business. The order is the result of a conference between the state commissioners and representatives of the telephone companies here several weeks ago. Besides prohibiting free and reduced rate service the order provides that a special rate of fifty per cent of the minimum residence rates may be charged for telephones in churches, lodges, hospitals, schools and religious associations. Stockholders of telephone companies must pay the same rates as non-stockholders.

Philadelphia Street Railway Transfers.

The Philadelphia Rapid Transit Company, Philadelphia, Pa., is determined to put a stop to the abuses which have grown up under the free transfer system. It is held by the management that the only way to do this is by abolishing them altogether, and making a slight charge for those passengers who desire to use them. Under the present system free transfers get into the hands of a great many people who had not ridden nor paid fares.

Institution of Electrical Engineers.

The council of the Institution of Electrical Engineers, of Great Britain, has nominated W. M. Mordey for president of the Institution for the ensuing year. The other nominations are: Vice-presidents, F. Gill and C. P. Sparks; council, T. Mather, Major W. A. J. O'Meara and A. Schwartz; associate member of council, J. E. Taylor; honorary treasurer, Robert Hammond.

INTRODUCING ELECTRIC HEATING AND COOKING APPLIANCES.

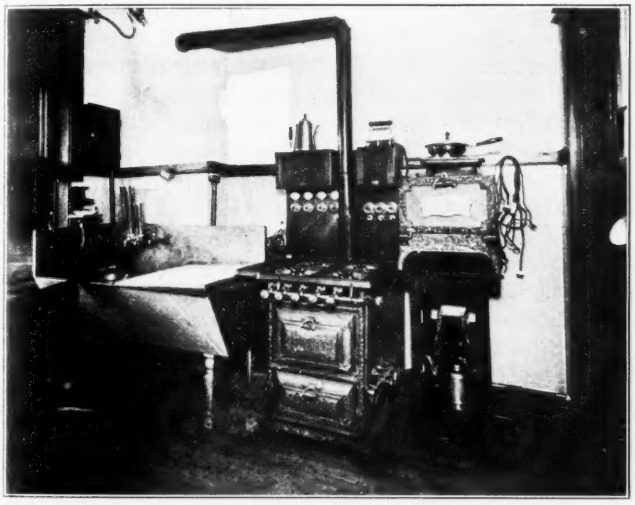
BY GEORGE B. JOHNSON, CONTRACT DEPARTMENT, COMMONWEALTH EDISON COMPANY, CHICAGO, ILL.

The question of how hard or how easy it is to introduce electric heating and cooking appliances in any given city depends primarily upon two things—the selling price of electricity and the selling prices of other sources of heat obtainable. With electricity in one city at ten cents per kilowatt-hour and gas at eighty-five cents per thousand cubic feet the problem is entirely different from that encountered where the price of electricity for heating and cooking purposes is two and one-half cents and the price of gas the same as above. Taking two cities with respectively the same rates as the above-cited cases and the local conditions in each being equal, *i. e.*, both doing the same amount of advertising, soliciting, etc., and the public being educated to the same extent on the subject of electric heating and cooking, the city with the low rate for electricity would theoretically use four times as much electrically heated apparatus per capita, since the charge is only one-fourth as much. As a matter of fact it would work out much more than this amount, as when the point is reached so that electric heat is sold nearly as cheaply as other sources it will almost sell itself and should practically gather its own momentum after being properly introduced. Therefore central stations which charge a low rate for this class of business have much the advantage of those which do not, and if such rates are in vogue in any town which is not getting its share of this business something must be radically wrong.

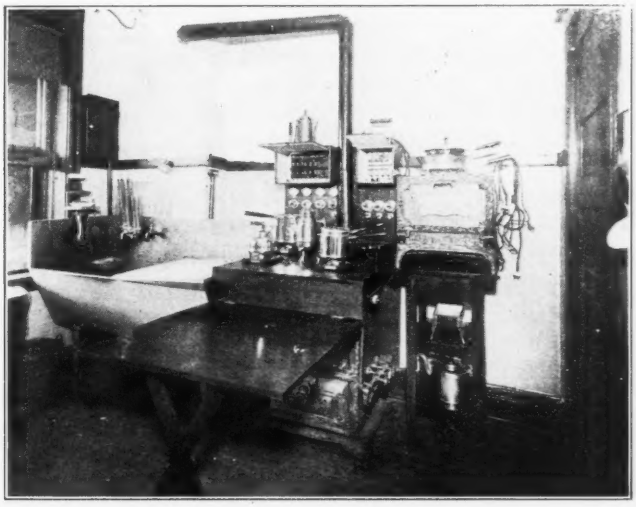
In introducing these appliances it is necessary to take into consideration the facts above noted and lay out the heating and cooking campaign accordingly. If the town has especially advantageous conditions for the introduction of complete cooking outfits, such as high-priced gas, expensive coal or low electricity, these outfits should be pushed at the outset, for such a town is in the best possible position to become completely electrified, for when these outfits are in successful operation all the other minor devices will quickly follow. On the other hand, if the town has disadvantageous conditions it would be the height of folly to hold back and do nothing at all.

Assuming that the latter conditions prevailed in a certain town and that it was decided to really do something, the smaller articles should be first introduced until their successful operation is demonstrated and the way paved for greater things. An advertising, soliciting and educational campaign should be laid out to cover not only one year, but five. The public should be gradually informed on the subject of the electric flat-iron. The irons should be advertised, distributed, followed up and made to stick by intelligent and painstaking efforts. In this work of educating the public, steady, persistent, common-sense methods must be used such as will inspire confidence and make the public realize that the company desires its hearty support and is anxious to co-operate with its customers to their mutual advantage. In no other branch of the business is it more important to have every purchaser satisfied. Electrical heating devices go directly into the hands of women in the home, and if satisfaction results, all is well, but one dissatisfied matron will spread the seeds of discontent among a hundred others, and the ground thus lost is hard to regain. For this reason it is necessary to see that the purchaser understands how to use the article when it is first bought and also that she is invited to let the company know at once if anything should occur after its purchase which would tend to make her doubt its successful operation. Most complaints will be found to be due to some trivial cause, which vanish upon a clear explanation of the "way it works."

Advertising matter regarding these devices should be followed up with calls made by a good solicitor. But the solicitor should be more than merely a seeker after orders. He should be a representative of the company in the true sense. His purpose should be of an advisory nature—to inform every customer all about these wonderful devices which lighten labor, bring comfort and make life more worth the living. He may secure orders if he can, but more important than orders at the start, is enlightenment. The amount of ignorance regarding these articles is amazing. A lady requested an electric flat-iron to be sent to her home, adding, after giving full directions by telephone as to where and when it should be delivered, "Be sure to send one with a large battery in it, as we do not use electric light." Another attached the iron to the telephone wire and complained because it would not heat up. On



AN ELECTRIC KITCHEN, WITH GAS STOVE AUXILIARY.



THE ELECTRIC KITCHEN, WITH THE GAS STOVE SHELVED.

the other hand, the novel uses sometimes made of these articles is interesting. An electric toaster is being used to good advantage by a gentleman for the purpose of placing under a chair in a portable bath cabinet. The coils from a water heater are used inside a chocolate-making machine in a candy factory to keep the chocolate melted to the proper consistency. An electric heating pad turned down to low heat and placed at the foot of the baby's crib will insure an even and beneficial temperature throughout the night and will also keep the milk bottle warm by laying it close to the pad. A steak may be beautifully broiled in a large-sized frying pan made by a certain manufacturer, thus doing away with the necessity of purchasing a separate device used only for broiling. Other cases constantly occur where the uses of electrical appliances more than fulfil the original design of the makers, and the wide-awake solicitor will find little difficulty in imparting some of his enthusiasm to the customers of the company as he calls upon them in the introductory campaign. In some cases he will find it necessary to curb an over-zealous enthusiast who is anxious to purchase a lot of articles which are unsuitable to his needs or which, if purchased and operated without further investigation, might react unfavorably for the future sale of such goods. There is a tendency toward this attitude on the part of customers regarding kitchen outfits. If the central station is not sure what it will cost to operate these outfits, certain customers or employés should be selected to install them and proceed to do all the cooking for a period of several months in order to secure the experience and data necessary to become thoroughly posted on the subject.

Where possible it is best to advocate the complete kitchen outfits as sold by the manufacturers, but where the space is limited, as in some apartment buildings, the stoves and utensils may be placed on an ordinary table, on a shelf, or if there is a gas or coal range which it is not desired to remove, a cover may be made to fit over it. The latter arrangement is shown in the illustrations herewith where the cover to go over the gas stove is constructed of one-inch oak, the front portion of which forms a table when raised and a shield when down for the purpose of preventing any possibility of the cook coming in contact with the stove. By referring to these illustrations it will be seen that the cutouts are located in the cabinets attached to the wall portion of the arrangement, each electric stove being connected to a separate cutout and all wiring strictly in accordance with Underwriters' rules. The cover is made removable, so that the gas stove may be used at any time by simply lifting it off. This construction was adopted to overcome any objection which might be made on the score that if it were made permanently fast over the stove the stove could not be used if at any time the electricity failed. This outfit has now been in use over seven months, every meal during this period being prepared by electricity and with not a single interruption in the electric service. The following data was obtained from this practical test:

Number days used	214.0
Number meals served	609.0
Number persons served (total)	1,747.0
Average person per meal	2.86
Total kilowatt hours used	462.0
Average kilowatt-hours per month	66.0
Average kilowatt-hours per meal	0.76
Average kilowatt-hours per person per meal	0.265
Average kilowatt-hours per day	2.16
Maximum kilowatts connected	6.0
Maximum kilowatts used at any one time	3.8
Number of persons in family regularly	3.0
Least number of persons served at once	1.0
Greatest number of persons served at once	9.0

From the above we see that the average kilowatt-hour per person per meal was 0.265, from which can be figured the cost per meal or month of any given family having approximately the same conditions. The family using this outfit has moderate means and is located in a flat with no servant. It should be mentioned that the above also includes the use of a 500-watt flat-iron by the laundress once a week. The washing was done on a gas stove in the basement. The oven was used about four times a week, but no bread was baked. Hot water was furnished by the building for all purposes except cooking. The electrical devices were as follows:

One General Electric oven.

One General Electric ten-inch frying pan.

One General Electric percolator.

One Simplex eight-inch stove.

One Simplex spray coffee urn.

Two Simplex six-inch stoves.

One Pacific toaster.

These articles, together with the utensils to fit on the stoves, were ample for all requirements, even when the family was increased to six members for one period of two weeks.

In order to introduce electric heating and cooking appliances the central station should provide an exhibition room in a central location, where all the different devices can be seen by prospective purchasers, and a capable attendant should be on hand at all times to explain their operation. Circular letters or invitations should be sent inviting every customer to call and examine them. Printed matter in the form of suggestions for Christmas gifts sent out just before the holidays will bring good results. An assortment of chafing-dishes, percolators, water heaters, curling-iron heaters, flat-irons, etc., sent to a church entertainment was deemed good advertising, and a letter received from an officer of a women's club thanking the company for sending a young lady representative with an automobile full of devices and treating the club to an "electrical afternoon" showed that the efforts were appreciated. Distribution of a recipe book containing recipes for the electric chafing-dish will help create a demand for this popular article. The progressive central station will leave no legitimate and dignified method untried to increase the use of these devices, which not only aid in popularizing electricity, but also materially assist in increasing the income.

"Engineering Honor."

Dr. Schuyler Skaats Wheeler, past president of the American Institute of Electrical Engineers and president of Crocker-Wheeler Company, Ampere, N. J., addressed the Engineering Society of Columbia University, May 4, on the subject of "Engineering Honor." As an undergraduate at Columbia, in the class of '83 he, with Professor F. B. Crocker, had addressed the same society on technical subjects.

After declaring that he felt the audience before him to be more sympathetic than any of the audiences he had addressed on engineering ethics, he alluded to the ethical codes of the various so-called learned professions. He spoke also of the code which he proposed in his presidential address before the American Institute of Electrical Engineers. He said that Francis Bacon had written a brief but comprehensive treatise on this subject in the preface to his "Maxims of the Law," as follows: "I hold every man a debtor to his profession; from the which as men of course do seek to receive contenance and profit, so ought they of duty to endeavor themselves by way of amends to be a help and ornament thereunto."

Dr. Wheeler mentioned the three great duties of the engineer in the order of their importance, first the engineer's duty to his client, second to the public and third to his engineering society. He condemned strongly the publication of false scientific and false engineering statements in the newspapers, and he declared that discoveries and inventions should be announced not in the daily papers but through the technical societies or the technical press.

TUNGSTEN DEVELOPMENT.

BY A. H. KELEHER.

The tungsten lamp is undoubtedly here to stay. One of the largest central station companies in the East has declared emphatically in favor of supplying its customers with the new lamp. Its use is widespread in many states. New England is especially progressive in its policy toward the metallic filament lamp and it can be safely said that there is no town of average importance in that section that is not actively engaged in educating its customers to a proper appreciation of the new lamp.

Many of the old objections against the use of the tungsten lamp have been removed. Shipments can now be made with but a small percentage of breakage. Some export houses will not now handle tungsten lamps, but it is only a question of a short time when equally small breakage will be the case with export shipments.

The life of the tungsten lamp is now on a satisfactory basis, recent tests showing 1,000 hours to be a conservative figure, and in some cases the life has reached 3,000 hours. It is quite within the realm of possibility that when the manufacture of the lamp is so perfected that a filament of pure tungsten metal can be secured that the average life may even exceed 3,000 hours.

It has been alleged that the watt consumption of a tungsten incandescent increases with its life. That such is not the case is indicated by careful tests made at the Massachusetts Institute of Technology by Professor Lawrence. These tests, while made on but a small number of lamps, showed after 300 hours burning: first, that the power taken by each lamp had not increased; second, the candle-power had decreased slightly, and third, the watts per candle had proportionately increased. Some tests now being made by the New London Gas and Electric Company give identical results with reference to consumption.

The time is rapidly approaching when the lamp can be used in any position. A test by V. R. Lansingh of a number of units burning at an angle of sixty degrees to the vertical failed to show any bad results due to the burning at an angle, with the exception that the weight of the filaments had caused them to sag a little. It has further been stated on the best of authority that the lamp companies are now recommending tungsten lamps for use in any position. In any case, as fixtures designed especially for the above lamps are now on the market, their use will not be retarded. These fixtures are designed for two, three, four, five and six-light forty, sixty or 100-watt lamps, which should be properly shaded to cut off the glare of the filament. Such combinations give an ideally broad light distribution, and are designed for interior lighting. The five-light sixty-watt tungsten, with prismatic reflectors, effectively replaces one four-burner gas arc consuming 19.6 cubic feet of gas per hour at a pressure of fifteen-tenths and giving a mean lower hemispherical candle-power of 224.5. The tungsten cluster has all the best of the gas arc with reference to the quantity and quality of the light delivered in the lower hemisphere. As to the cost per year to the consumer of the two classes of illuminants (cost of lamps, maintenance and fixtures included), it is about an even break between the two. We are therefore enabled by using the tungsten cluster to put the gas arc out of business from the start.

There are many ways of showing this gain in economy. A contractor in Norwich, Ct., points out this saving, using as an example one 100-watt tungsten against five sixteen-candle-power carbon incandescents, the candle-power in each case amounting to eighty. In the course of one year, the saving by using the modern unit amounts to $22.26, as can be seen from the following figures:

Five sixteen-candle-power, 3.5-watts-per-candle, carbon incandescents—

$5 \times 56 \div 1{,}000 = 0.28$ kilowatt consumption.

Assuming the lamps to be burned three hours a day for $365 - 52 = 313$ days per year, the yearly kilowatt consumption is $0.28 \times 3 \times 313 = 257.32$.

As a fifteen-cent rate is charged in Norwich, the cost of energy per year is $257.32 \times \$0.15 = \$38.60$.

No charge for lamp renewals.

One 100-watt tungsten—

Energy consumed per year by this unit $100 \times 3 \div 1{,}000 = 0.3$ kilowatt-hour per day. $0.3 \times 313 = 93.9$ kilowatt-hours per year.

$93.9 \times \$0.15$	$14.09
Cost of lamp	2.25
	$16.34 = yearly cost.

The results obtained in store-window lighting with tungsten lamps are remarkable. A druggist in New London, Ct., using five twenty-five-candle-power carbon incandescents in each of two show windows became dissatisfied with the quantity and quality of light received upon his goods. The electric lighting company, which, by the way, is progressively pushing tungsten lamps, replaced this consumption of 435 watts per window by a 100-watt frosted-tip lamp equipped with prismatic reflector. The customer is enthusiastic over the improved illumination and lower cost. In the vicinity of this store, other windows lighted by the old style incandescents are made to look jaundiced in comparison. In the same town, five 100-watt tungstens placed nine and one-half feet above the floor of the window and four feet apart have replaced 1,495 watts, the resulting illumination being as good as that of any show window on Broadway. Numerous other instances of saving by the new lamp could be cited, the results being similar to the above. The policy of the New London company is liberal. It is willing to cut down the connected capacity one-third, believing that one satisfied customer is as good as ten of the disgruntled kind, while further it is thought that in the end the customer, becoming more liberal in the use of light costing him so little, will make use of more illumination than before.

In closing, it might be advisable to say a few words about the present situation in street lighting as affected by the use of the series tungsten. Many of the existing contracts between the lighting companies and the muncipalities expire this spring. In almost every case new contracts will be on a new charge basis, and will call for the tungsten lamp. The municipality will get more light for the money expended, while the lighting company will share in the benefits accruing from the use of the more efficient lamp. The lamp alone does not satisfy the conditions for ideal street lighting. Most of the light from a bare lamp is thrown out in the horizontal direction, and very little illumination is secured immediately below the lamp, due to the small end-on candle-power available. Some method for controlling the light rays and throwing them up and down the street, out from the curb line, should be used so as to avoid absorption due to trees, posts, etc. At the same time much of the light toward the house side should be suppressed, avoiding glare in the eyes of people sitting on their porches; and the intensity across the street diminished, as the maximum illumination is not needed there. Another condition to be filled is to have the maximum rays of light in the horizontal plane so controlled that they are directed at about ten degrees below the horizontal. As a reflector which will do these things is now on the market, lighting companies are in a position to give the public a better street illumination than it has had in the past.

FUELS.

BY CHAS. L. HUBBARD.

The most important of all fuels for the generation of steam power, and in many localities the only one, is coal in its numerous grades and forms. In some places wood, gas and oil are abundant and therefore take the place of coal, and in certain manufacturing plants the waste products, such as straw, tan, sawdust and bagasse, are available in sufficient quantity, and therefore serve as fuel more economically than coal; but in the case of electric power plants coal becomes practically the only fuel to be considered, unless it be oil or gas, in certain localities in or near the oil-producing regions.

All coals are of vegetable origin and are derived from plants which grew in past geological ages. It is believed that the conditions under which these plants grew are similar to those of modern peat swamps, except that a tropical heat prevailed, and the areas of vegetation were continental in extent. The coal fields of the United States are ranked under six geographical divisions, as follows: Appalachian, Northern, Central, Western Central, Cordilleran or Western, and New England, and have a total area of about 216,000 square miles.

Coals are broadly divided into two kinds: anthracite and bituminous, and these are subdivided into hard anthracite, semi-anthracite, semi-bituminous, bituminous, cannel and lignite.

Anthracite coal is found chiefly on the eastern slopes of the Alleghanies in Pennsylvania and to a limited extent in the Rocky Mountains. The bituminous varieties are found from the Alleghanies westward to the Mississippi, and again in the foothills of the Rocky Mountains, and in limited areas of these mountains and also on the Pacific slope. Semi-bituminous occurs chiefly in Pennsylvania, Maryland and West Virginia. Cannel coal is practically limited to Kentucky, Ohio and Indiana, while lignite is the principal variety of the western slope of the Rocky Mountains.

Anthracite coal is a hard variety and consists almost entirely of carbon, having but a small percentage of hydrocarbon. The best quality is hard and lustrous and breaks up easily at a high temperature. It burns with very little flame and smoke, unless wet, and gives an intense heat. In order to get the best results with this coal a grate with small air spaces should be used.

Owing to the brittleness of the coal, part of it is broken into fine pieces, which would be lost if coarse grates were employed.

The typical composition is as follows:

	Per Cent.
Carbon	90 to 94
Hydrogen	1 to 3
Oxygen and nitrogen	1 to 3
Water	1 to 2
Ash	3 to 4

The semi-anthracite or semi-bituminous variety of the anthracite class is distinguished from the hard anthracite by possessing a black hue with less metallic lustre. It contains more hydrocarbon and is not so hard as the anthracite proper, and burns with a short flame.

Its typical composition is as follows:

	Per Cent.
Carbon	84.0
Inflammable gas	7.5
Water	2.5
Ash	6.0

Bituminous coal ranges in color from pitch black to a dark brown; its lustre is resinous, vitreous, or silky.

Some grades burn freely without caking, while others become pasty and swell while burning. The latter is used largely for making illuminating gas.

The typical composition of bituminous coal is:

	Per Cent.
Carbon	52 to 84
Volatile matter	12 to 48
Ash	2 to 20
Sulphur	1 to 3
Water	1 to 4

Lignite, or brown coal, is intermediate between peat and coal. Its lustre is resinous to dull black or brown, and it burns with a bright flame, which is only slightly smoky. There is a large variation in its moisture, some varieties containing as high as thirty-four per cent.

The typical composition of average Texas lignite is as follows:

	Natural Condition. Per Cent.
Moisture	33.37
Vol. and Combust.	40.39
Carbon	17.24
Ash	9.0
Sulphur	1.12

Cannel coal, sometimes called long-flaming bituminous, has a tendency to smoke, and some varieties cake when heated. It contains from seventy to eighty-five per cent of carbon. Coke is produced by driving off the hydrocarbons of bituminous or semi-bituminous coals by means of heat. When made in gas retorts it has a low value as a fuel. When made in coking ovens it is dark gray, hard, porous and brittle. Coke burns without flame and will, if forced, make a hot fire. While wood is not used in steam plants of any size, it may be of interest to mention briefly its value as a fuel as compared with coal.

Wood, when considered as a fuel, is divided into two classes, known as hard and soft. The heating value for a given weight is very nearly the same for different kinds; that is, one pound of hickory or maple is worth no more as fuel than one pound of pine. Wood contains considerable moisture even when kept for a long time in a dry place; after being thoroughly dried it will absorb from ten to twenty per cent of moisture. The chemical composition of woods is nearly the same, and is shown approximately in the following table:

	Perfectly Dry. Per Cent.	Ordinary Fire Wood. Per Cent.
Carbon	50	37.5
Hydrogen	6	4.5
Oxygen	41	30.75
Nitrogen	1	0.75
Ash	2	1.5
Moisture	..	25.0

Wood that is kiln-dried has a theoretical heat value of about 8,000 heat units per pound, so that wood containing twenty-five per cent of moisture has a value of only about 6,000 heat units per gross pound.

The most important elements in coal are oxygen, which produces 14,500 heat units per pound, and hydrogen, which produces 62,000 heat units per pound when burned. The heat value of a coal depends upon the amount of carbon and hydrogen which it contains, and although several coals may have the same total percentage of combustible and ash, the heat values may differ. The value of any fuel is obtained by chemical analysis or by calorimetric test, and varies in coals from different localities.

HEAT VALUES OF DIFFERENT VARIETIES OF COAL.

Kind of Coal.	Per Cent Ash.	Theoretical Heat Units per Pound.	Theoretical Evaporation of Water in Pounds per Pound of Coal.
Pennsylvania anthracite	3 49	14,199	14.70
Pennsylvania anthracite	2.90	14,221	14.72
Pennsylvania cannel	15.02	13,143	13.60
Pennsylvania Connellsville	6.50	13,368	13.84
Pennsylvania semi-bituminous	10.77	13,155	13.62
Pennsylvania brown	9.50	12,324	12.75
Kentucky caking	2.75	14,391	14.89
Kentucky cannel	2.00	15,198	16 76
Kentucky lignite	7.00	9,326	9.65
Indiana caking	5.66	14,146	14.64
Indiana cannel	6.00	13,097	13.56
Maryland Cumberland	13.98	12,226	12 65
Arkansas lignite	5.00	9,215	9.54
Colorado lignite	9.25	13,562	14.04
Texas lignite	4.50	12,962	13 41
Washington lignite	3.40	11.551	11.96
Pocahontas	4.70	14,100	14.61
New River	4.60	13,900	14.40

The above table gives the heat units per pound for the perfect combustion of different kinds of coal; also the theoret-

ical evaporation that would be obtained if all of the heat given off were delivered to the water by the boiler.

The theoretical evaporation is never obtained in practice, due to the various heat losses from the boiler and furnace. Among these the more important one, radiation from boiler and setting, admission of cold air to the furnace, imperfect combustion and the heat carried away in the chimney gases.

A boiler seldom gives an efficiency of more than eighty per cent, and sixty-five to seventy per cent is more usual. This gives about 9,800 heat units as utilized by the average boiler from a pound of the best grades of coal, or an evaporation of about ten pounds of water per pound of coal.

The effect of a high percentage of ash is not only to lower the proportion of combustible in the coal, but causes certain losses in other ways. It indicates a measure of loss through the unconsumed carbon which it contains, and also through the heat lost when the ash is removed in a heated condition. Again, its effect in clogging the grates and preventing free combustion tends to lower the efficiency of the furnace. Commercially, its presence adds to the cost of freight, and the removal of the ashes from the boiler room to a suitable dumping place is often an item of considerable importance. The percentage of carbon in the ash, either in the form of cinder or fine particles of coal, varies greatly and may run from ten to sixty per cent. This loss can often be considerably reduced by the use of suitable grates and careful firing.

The amount of moisture contained in coal varies greatly, depending upon its character, its temperature and previous exposure to the atmosphere. This has an important influence upon the theoretical heat value of the coal, because it must all be raised to a temperature of 212 degrees, evaporated into steam, and the steam raised to the temperature of the escaping gases.

The size, under certain conditions, has a very important influence upon the efficiency of coal, particularly in the case of the anthracites. For the freest burning the particles should be of as nearly a uniform size as possible.

In the smaller sizes, consisting of culm and screenings and slack, it is usually necessary to mix them with a certain proportion of bituminous coal and burn upon special grates and under a forced draft. The important factors in the successful burning of small anthracite coals are given in "Mechanical Draft" (B. F. Sturtevant Company), as follows:

First—Mechanical draft, preferably applied beneath the grate.

Second—Large grate area.

Third—Grate constructed with a practically plain surface to prevent lodgment of coal.

Fourth—Grate of proper design for ready removal of ash and clinker.

Fifth—Air spaces not over one-sixteenth to three-sixteenth inch wide, except for No. 1 buckwheat or bituminous slack, for which they may be one-fourth inch wide.

Sixth—Arrangements to allow of the feeding and cleaning of fires without excessive opening of doors or dropping of ashes into the pit.

Seventh—Thin fires and careful firing. The thickness of the bed should diminish with the rate of combustion.

Eighth—Reduction of draft above the fire as the rate of combustion decreases.

An article of this kind is hardly complete without a brief reference to oil fuel.

Petroleum, the oil used, is a hydrocarbon liquid composed of carbon, hydrogen and oxygen in slightly varying proportions, of which the average is: Carbon, eighty-two to eighty-seven per cent; hydrogen, eleven to fifteen per cent, and oxygen, one-half to six per cent.

The heat produced by the combustion of one pound of petroleum under average conditions ranges from about 17,000 to 20,000 heat units, as against 12,000 to 14,000 for an equal weight of coal, which marks the heat value of one pound of oil equal to about one and one-half pounds of coal.

This ratio sometimes runs higher than that given above, under favorable conditions, and some authorities consider one pound of oil equivalent to two pounds of coal. Under average conditions it is customary to consider from three and one-half to four and one-half barrels (forty-two gallons per barrel) of oil equivalent to one ton of coal (2,000 pounds). In order to make a comparison of the costs of the two fuels for any given locality due allowance must be made for the reduction in the item of labor in the case of oil.

Two kinds of oil are commonly used, one being the crude petroleum as it comes from the wells, and the other the residuum which is left after the lighter oils have been distilled. There are three general classes of oil burners in common use, as follows: Mechanical spray burners; air burners, where the oil is sprayed into the furnace by means of a jet of compressed air, and steam jet burners, in which steam is used instead of compressed air.

Tests made by the United States Government some time ago seem to indicate that the best results were obtained by the use of either steam or air alone rather than by a combination of the two. Burners using steam are considered preferable for large furnaces with much brickwork, as they spread the flame more. Air burners concentrate the flame and are more destructive to plates and walls.

Complete combustion, cleanliness and economy of labor are important factors in the use of fuel oil.

BOOK REVIEWS.

"Telephone Construction, Installation, Wiring, Operation and Maintenance." W. H. Radcliffe and H. C. Cushing, Jr. New York. Norman W. Henley Publishing Company. Cloth. 172 pages. Illustrated. 4½ by 7 inches. Furnished by the ELECTRICAL REVIEW for $1.

This book is intended as a guide and handbook for the amateur and telephone wireman. It gives only the most elementary explanation of the physical phenomena involved in the operation of telephone apparatus, but contains detailed instructions for the installation of all types of telephone apparatus, for the erection of lines, running of cables, and other similar work.

"The Steam Turbine." Robert M. Neilson. New York. Longmans, Green & Company. Cloth. 604 pages. Illustrated. 6 by 9 inches. Furnished by the ELECTRICAL REVIEW for $4.20.

This is the fourth edition of this well-known treatise on the steam turbine. It has been revised and enlarged in order to bring the subject up to date and to enable descriptions of the latest applications of the steam turbine to be included in the book. The subject is treated by giving first a chapter on fundamental notes and definitions. This is followed by a history of the steam turbine, and then a theoretical discussion of the conversion of the heat energy of steam into kinetic energy is given. Next there is a classification of the different types of steam turbines, a discussion of the losses and efficiencies occurring in each, and of the proper vane speeds to be employed. The author then takes up, somewhat in detail, the discussion of the different types of turbines, a discussion of the losses and effi- effects of steam pressure, superheat and vacuum upon the efficiency of the turbine. Next, attention is turned to the apparatus which is to be driven by the turbine, such as electric generators and ship propellers, the results of tests of turbines used in these various ways being given. There are also descriptions of a number of well-known power plants and marine installations.

Electric Heating in the Laundry.

A few years ago "Steam Laundry" or "Troy Laundry" were words to conjure with in securing the trade for a laundry. To-day a few enterprising concerns are advertising "Electric Laundries" and find it a drawing card. The electric light has been used in the laundry for years and the group and individual motor drive are not uncommon. In the large commercial laundries and the laundries attached to modern hotels, institutions, ocean liners and warships, it has been found that electric heat can be used to advantage for many of the machines and for hand ironing.

The electrically heated sad-iron has many advantages over the flat-iron and charcoal or gas-heated sad-irons. The latter two irons are not often employed in regular laundry work but are used in the piece laundries attached to industrial plants. At the best the laundry employing gas or charcoal-fired heating stoves for their irons is an uncomfortable place for the worker, and such concerns experience the greatest difficulty in holding their help during the hot summer months. In most laundries the bundle department a great gain in comfort to the worker and as a compensating advantage it has been found that the girls turn out more work and stick to their positions. A further advantage is that the news of the use of electrically heated sad-irons and their convenience circulates rapidly among the workers and the laundry equipped in this

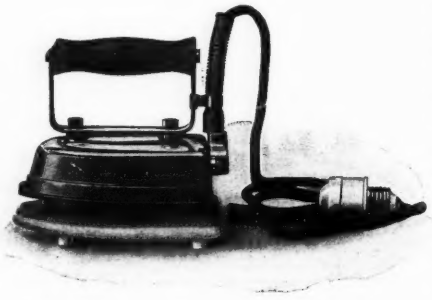


FIG. 1.—WESTINGHOUSE ELECTRICALLY-HEATED SAD-IRON.

manner is able to take the pick of the skilled ironers available, and can maintain the force at its highest efficiency.

There are several kinds of electrically heated sad-irons on the market, but the most satisfactory results are attained by those irons which are devoid of all complicated switches and regulating devices. Experience has shown that the workers do not take kindly to such frills, and in addition it is difficult to keep such irons in repair. The simple, solid, sad-iron whose heat is regulated by turning the current on or off by the socket switch has proven itself the only satisfactory iron for laundry service. An iron of this character is shown in Fig. 1. These irons can be supplied in five, seven and nine-pound sizes, the latter being the best adapted to general laundry work, but the lighter irons are necessary in finishing some of the lighter garments.

Electrically heated rolls and pads have been successfully applied to a number of different ironing machines. Electric heat has many advantages over steam or gas heat for ironing rolls. With the latter it is impossible to get an evenly distributed heat, the same at all portions of the surface of the roll. Some parts of the roll are colder than others, too cool to use in many cases. The heat can not be closely regulated and therefore the speed of the machine must be altered in many cases to suit different grades of work. Hence the output of the machine is reduced. Steam results in more or less drippage and the swivel glands at the roll axles are difficult to keep tight. This continual leakage causes more or less discomfort and dirt in the work room. High-pressure steam must be used in order to attain the temperatures required and there is some danger of an explosion should the cast-iron roll get cracked from a strain while

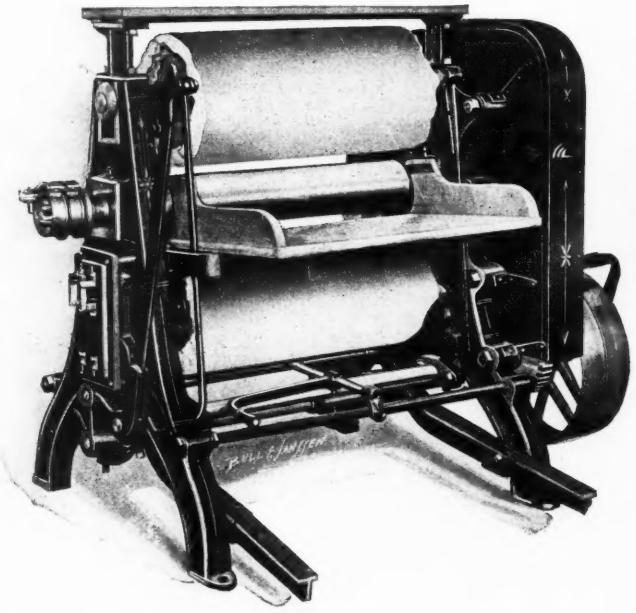


FIG. 2.—COLLAR AND CUFF IRONER WITH HADAWAY ELECTRICALLY HEATED ROLL.

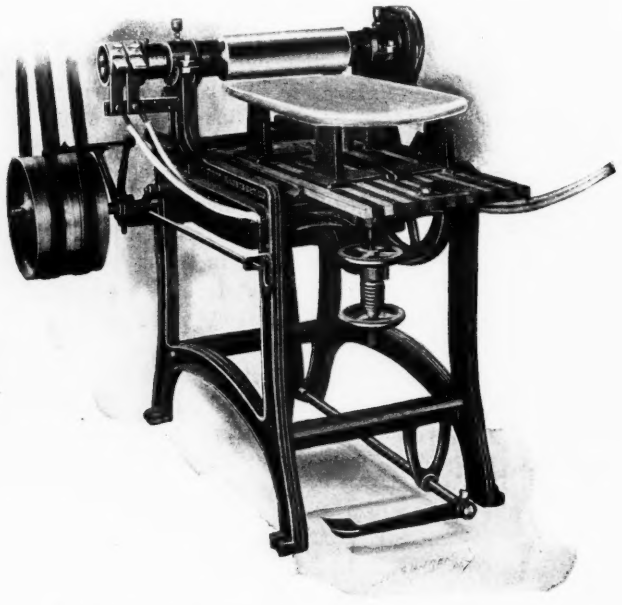


FIG. 3.—BOSOM IRONER, WITH ELECTRICALLY HEATED ROLL.

seems to be a constant procession of semi-competent ironers. The girls who can do good work will not stay unless their comfort is consulted, and the unskilled labor causes a constant loss to the laundryman through reduced output and the damaged goods. The introduction of the electric sad-iron into the laundry has resulted in heating or cooling. The gas and steam-heated rolls are slow to heat up, and cool quickly. Gas heating often requires the installation of a special gas plant, and in some localities severe insurance regulations must be complied with in order to keep the policies in force.

When electric heat is used the rolls are

held at a constant temperature over their entire surface which is equivalent to an actual increase of from twenty to twenty-five per cent in the heating surface available for actual use. The heating element is embedded in a solid roll whose heavy central core acts as a thermal storage reservoir or equalizer, by which heat is stored or given out as the irregular demands of the work require. This method of construction enables a constant input of heat to take care of a varying demand. Occasionally two or three different working temperatures are desired and a method of heat control has been devised which permits this regulation and entails no loss in the electrical efficiency of the heating element. The electrically heated roll is hot at the ironing surface and this avoids the journal troubles so often found with steam or gas-heated rolls. The heat is flameless and

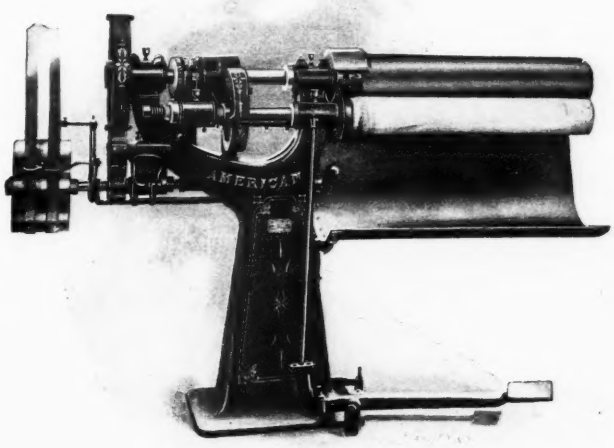


FIG. 4.—BODY IRONER, WITH HADAWAY ELECTRICALLY HEATED ROLL.

does not vitiate the air of the workroom and there is no unnecessary steam leakage to increase the humidity of the air.

In the large laundries and other places where the electrically heated rolls form a portion of the load of an isolated plant, it is often found that their use does not increase either labor, fuel or fixed charges perceptibly, but it does increase the load-factor of the plant and the machinery operates at a higher efficiency during the day load.

The accompanying illustrations, Figs. 2, 3 and 4, show some typical laundry machinery with electrically heated rolls. These machines have proven exceedingly efficient in operation and in many cases the adoption of electric heat has resulted in a considerable increase of output from the machines.

The Safety Exposition of the American Museum of Safety Devices.

The safety exposition, under the auspices of the American Museum of Safety Devices, 231 West Thirty-ninth street, New York city, is attracting a great deal of attention from people in every walk of life. Among the devices now on exhibition is a miniature model of a mine gallery, showing how construction of steel instead of wood is being used to make the galleries of mines safe and strong. This installation has been made by the Carnegie Steel Company, and can be studied in all its details. In close proximity are safety lamps, respirators, helmets and detectors of dangerous gases. There is also a model of a train-control system, which shows how the despatcher, in his own office, with the train sheet in front of him indicating the whereabouts of every train on the line, can talk at will with any engineer in his cab at any point on the line. If the directions to the engineer should not be heeded, the despatcher, by turning a lever, can shut off the power on the locomotive.

There is also shown a model of a quadrant davit, whereby two men can lower a lifeboat filled with people from the deck to the water in a minute. A system of tubes running from various parts of a vessel below deck to a central compartment, indicating the presence of fire in any part of a ship, is on exhibition. A suction fan draws the smoke through the tube, showing the compartment in which there may be a fire. The officers in charge screw a cap on this pipe, and by turning a valve let in live steam to the compartment, quenching the fire. There are also exhibited safety exits, fireproof doors, automatic sprinklers, fire-escape ladders, and a fireproof house of hollow tile.

Of interest to machine-tool men are numerous devices which interpose safeguards protecting workmen's hands, pushing the fingers away from cutting knives or punches. There are also safety elevators, emergency brakes, rail joints, automatic gate-crossings, signals, life buoys, collapsible lifeboats, safety hatches, life guns and safety clotheslines.

The safety exhibition will be open free daily to the public, except Sunday, from 10 A. M. until 6 P. M., until June 1. The committee of direction of the museum includes some of the leading engineers and technical men in America.

Sound Distortion in Wireless Telephony.

TO THE EDITOR OF THE ELECTRICAL REVIEW:

In Erskine's translation of Ruhmer's "Wireless Telephony" there occurs in the appendix thereto, page 201, a remark to the effect that it has been noticed by a telephone expert that in wireless telephony there does not appear to be any distortion of sounds with distance as is the case of all line wires. The inference is that this is a recent and unlooked-for result or discovery. The present writer has for a long time held the opinion that this result might be expected. For example, in a communication to Sig. Musso, October 6, 1902, concerning a proposed synchronous wireless telegraph system, he wrote: "This detrimental effect (due to static capacity of land lines) would not be present in a synchronous system operated by wireless telegraphy, which is doubtless an advantage in favor of wireless telegraphy for this purpose." Again in his book, "Wireless Telegraphy" (1904), in the description of Musso's wireless synchronous telegraph the following language occurs: "It may be noted that wireless synchronous systems do not have to contend with the 'tailing' effect due to static capacity as on wire lines," but, it is added, "doubtless other troubles equally difficult to overcome will be met with."

However, while the distortion due to static capacity of land lines is absent in the case of wireless telephony, there still remains to be dealt with the distortion due to the terminal apparatus, which some authorities regard as of more consequence than that due to the static capacity of open-wire lines in long-distance telephony, on which loss of volume appears to be a greater cause of imperfect working than distortion of the waves. Analogously, although due to a different cause, loss of volume is also a serious impediment to long-distance wireless telephony, which however it is hoped will be measurably obviated by higher power transmitters.

WILLIAM MAVER, JR.

New York, May 6.

Curtis Turbines in the Power Plant of the Nashua Manufacturing Company.

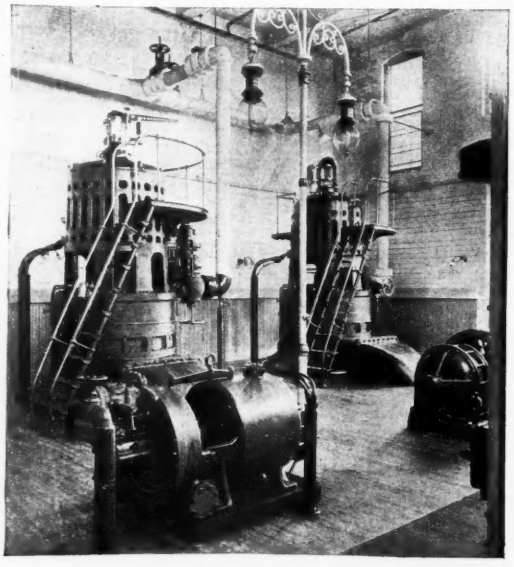
The increasing use of steam turbines in industrial plants is a striking testimony to their many good qualities. While admitting the advantages of high efficiency, compactness, simplicity and the low cost of maintenance inherent with this type of prime mover, many are inclined to think that an excessive amount of auxiliary apparatus is required. An examination of the accompanying illustrations, showing the interior of the Nashua Manufacturing Company's power plant at Nashua, N. H., will convince the observer of the simplicity of a properly installed turbine plant.

Two 500-kilowatt, 600-volt, three-phase Curtis steam turbines, one motor-generator set, one steam-turbine generator set and a small circulating pump for the oiling system constitute the only moving apparatus in the station. The condensers, of the Manning-Bulkeley type, are located on the outside of the building, where a sufficient head of water is provided for syphoning. No trouble is experienced in maintaining a vacuum of twenty-eight inches to twenty-nine inches, and as a consequence the only pump in the entire installation is the one furnishing oil to the bearings.

The excitation for the 500-kilowatt units is provided at starting by the twenty-five kilowatt Curtis turbine-generator set. This set also furnishes power for operating the watchman's lights throughout the factory and for lighting the boiler and engine room. Continuous excitation is furnished throughout the day by the thirty-five-kilowatt induction motor-generator set.

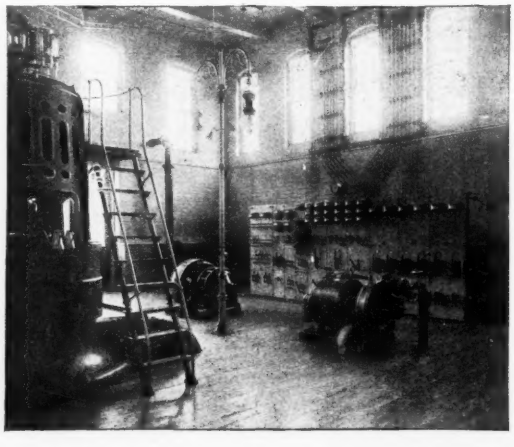
The switchboard consists of generator, exciter and feeder panels of blue Vermont marble, and is furnished with the necessary meters and apparatus for controlling the generators, exciters and feeder circuits.

The Nashua Manufacturing Company is an extensive manufacturer of cotton goods. The group system of electric drive is used throughout the mill, the motors being of the induction type built by the General Electric Company. Besides furnishing current for the motors, the turbines also supply current for lighting the mill. The decision of the company to install Curtis turbines was made after thoroughly canvassing the prime-mover field. The initial installation, consisting of one 500-kilowatt unit, gave such satisfactory operation that two years later a similar unit was installed to meet the increasing demand for power.



CURTIS TURBINES IN THE ENGINE ROOM OF THE NASHUA MANUFACTURING COMPANY, NASHUA, N. H.

The first unit after being in continuous service some thirty months, ten hours per day, was taken apart and examined. The excellent condition in which the steel buckets and the entire interior of the turbine was found appears to refute the popular belief that steam at high pressure with more or less entrained water acts as a corrosive agent on the turbine buckets.



ANOTHER VIEW, SHOWING SWITCHBOARD IN THE ENGINE ROOM OF THE NASHUA MANUFACTURING COMPANY, NASHUA, N. H.

The Failure of the Hauserlake Dam of the Missouri River Power Company.

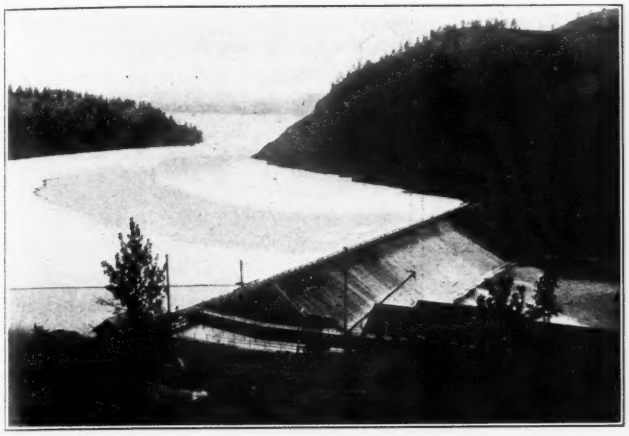
About a month ago considerable stir was caused in engineering circles over the report of great damage to the Hauserlake dam and power plant of the Missouri River Power Company, during the flood which swept that section of the country about the middle of April. The damage appears not to have been nearly so extensive as first reported.

The Hauserlake power plant is located on the Missouri River, about eighteen miles from the city of Helena, Mont. The dam is seventy feet in height, 630 feet in length and was built of steel bents supporting curved steel plates forming the water face of the dam. Both ends of the dam were founded on the solid bedrock, but about 400 feet in the centre section was on a gravel foundation. The dam was anchored at the up-stream toe to Freistedt sheet piling, driven in the hard river ground. There was also a rubble masonry fill at the up-stream toe located under the plates and down-stream from the sheet piling.

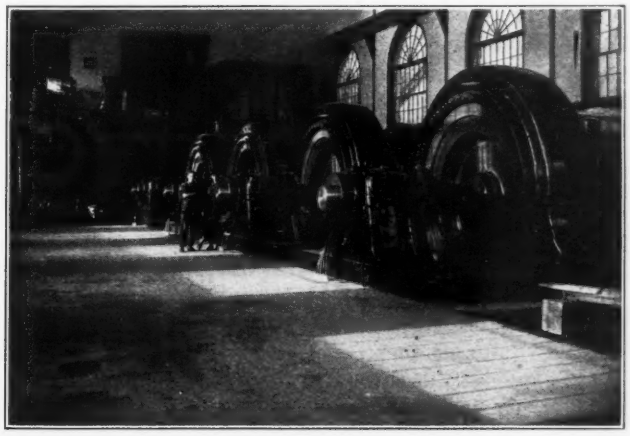
The dam failed April 14, at about 2:30 P. M. The initial break occurred at bent 39 about 400 feet from the east or power-house end of the dam. The anchorage at this point apparently gave way, breaking the seal and allowing the water to pass under the rubble-masonry fill. The water rapidly cut away the gravel, permitting settlement of this up-stream masonry and carrying down with it the lower end of the girder forming the upper member of the steel bent. The expansion joint in this girder and in the plates of the dam just above the top of the masonry gave way, leaving the bents and plates unsupported in such a manner that the water pressure pushed over this section. About six minutes elapsed from the time the water first came through under the rubble masonry until the expansion joint failed and the first bent toppled over, carrying out a section about thirty feet in width. The tremendous rush of water rapidly widened this breach, the foundations on each side were undermined, and the posts and steel work buckled at right angles to the direction of the flow of the river. The bents continued to give way and fall until the breach widened to nearly 300 feet. The photographs show the break looking down-stream after the water subsided. The break at the expansion joint referred to is plainly seen in the picture on the right-hand side of the breach near the water level. The plates

of the dam can be seen torn open along this line.

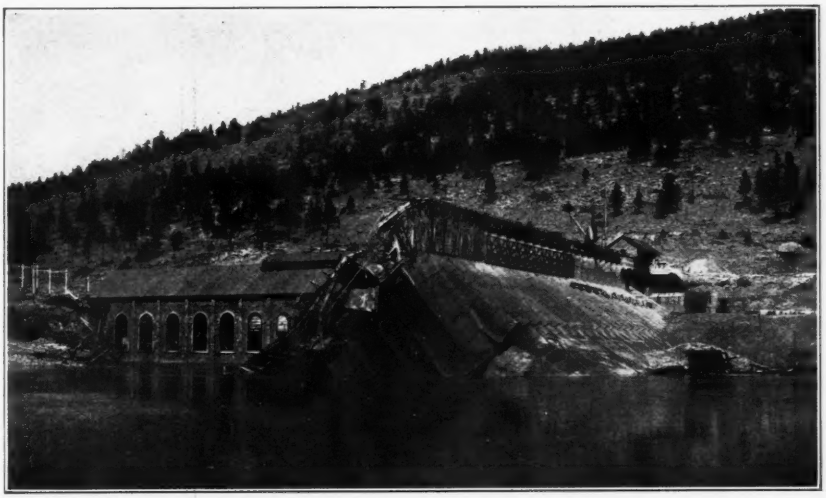
The steel dam was designed and built by the Wisconsin Bridge and Iron Company under a general guaranty, and its acceptance has been the subject of a prolonged controversy. Structural weakness was claimed and the matter was submitted to arbitration, and the builders have until very recently been making repairs and strengthening certain parts of the structure. At the time of the accident the matter of acceptance and final settlement was in the hands of the attorneys of the power company.



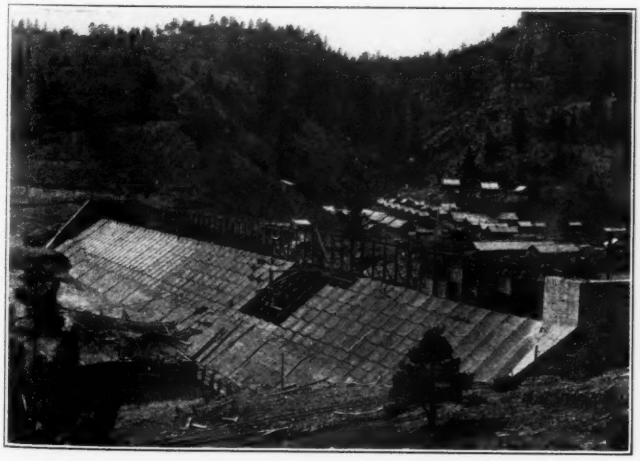
View of Hauser Lake, Looking Upstream.



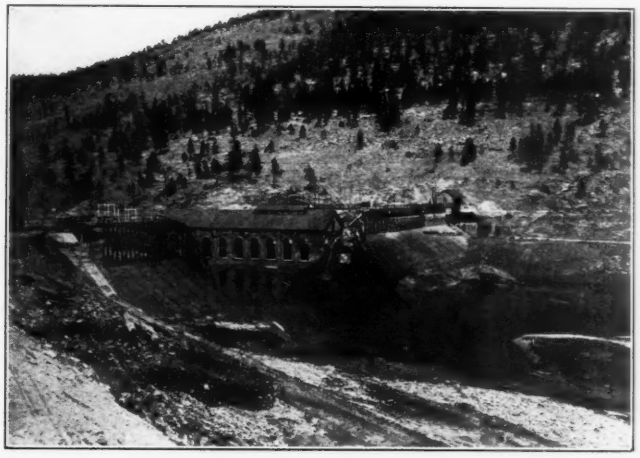
Interior of Power-House, Hauser Lake Station.



Break in Hauser Lake Dam, Looking Downstream, Missouri River Power Company.



Hauser Lake Dam, Under Construction.



Break in Hauser Lake Dam, Looking Downstream.

The power-house is of steel and masonry and contained five hydraulic and electrical units of 4,000 horse-power each. The water-wheels are mounted on horizontal shafts and located in steel penstocks. The generators are three-phase, sixty-cycle alternating-current machines. The electrical power generated was stepped up to a pressure of 70,000 volts and was transmitted to Helena and Butte, the plant being operated in parallel with the plant of the Missouri River Power Company located at Canyon Ferry, Mont., also on the Missouri River. The power-house and machinery sustained but very little damage. The electrical machinery was dried out and it is estimated that the total loss to the power plant will not exceed $5,000.

Although much apprehension was felt, the flood did remarkably little damage, this being due largely to the fact that the river passes through canyons for twenty-eight miles below the Hauserlake plant and the shores in this section of the river were uninhabited, the property

belonging to one of the power companies. Below this point a few houses and fences were carried away and there was some damage to the track of the Great Northern Railway, but there was no loss of life. By the time the flood reached Great Falls, a distance of about one hundred miles, it had been so distributed that the usual high-water mark of the river was not reached and there was no damage whatsoever at that point. The total damage to property other than the dam, due to the flood, is estimated at about $30,000.

At the time of the failure the power was being used in the Butte mines and smelters, but the auxiliary steam plant located at Butte was immediately started up and this plant, together with the hydraulic station at Canyon Ferry, is carrying practically all of the load, so there has been no serious interference with operations at Butte nor at Anaconda. Electric power for the city of Helena is supplied entirely from the Canyon Ferry plant and for that reason there was no interruption of service in this city. The total damage has been variously estimated from $250,000 to $300,000, and the time to make the necessary repairs at about six months. The dam will be immediately repaired.

In addition to showing the condition of the wreck, one picture illustrates the dam during construction, another the dam after completion, and still another picture shows the interior of the power plant with four generators in operation.

Ithaca Section of the American Institute of Electrical Engineers.

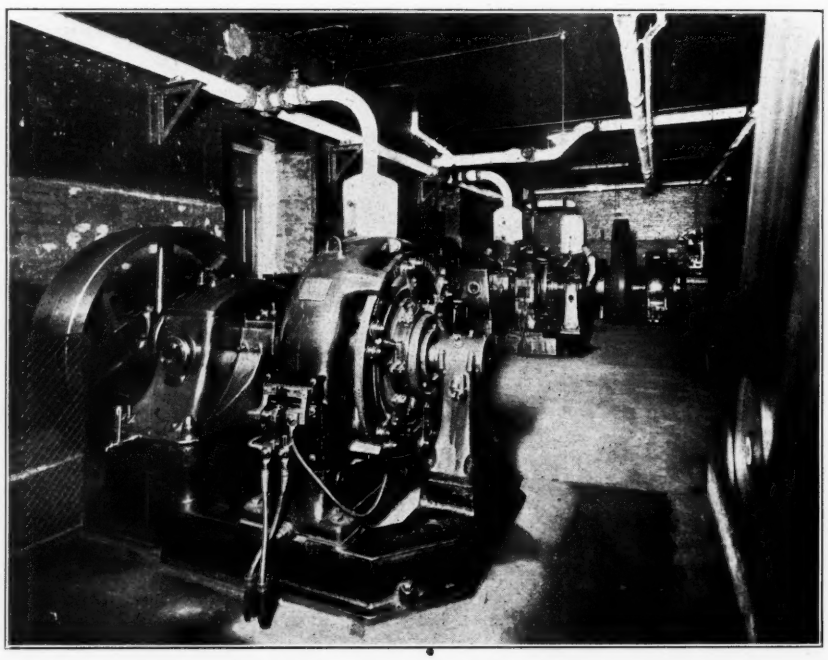
A meeting of the Ithaca section of the American Institute of Electrical Engineers was held on April 17, when Dr. C. P. Steinmetz delivered an address on "The Alternating-Current Commutator Motor." He described the various types which had been developed; explained the difficulties of securing good commutation in such motors; pointed out how compensation for the reactance and transformer voltages introduces complications, and showed the latest inventions and devices for insuring satisfactory commutation at various loads and speeds. The lecturer stated that this type of motor is not by any means new, as one of his first tasks upon his arrival in this country in 1889 was the designing of such a motor with Rudolph Eickemeyer.

During his visit to Ithaca Dr. Steinmetz also gave an interesting talk at the annual dinner of Sibley College. This dealt with his early experiences in Germany and Switzerland, and his first work with Mr. Eickemeyer in this country. These addresses were well attended, about 350 being present at each.

The Plant of the Union League Club, of Chicago, Ill.

The Union League Club is located at Jackson Boulevard and Custom House Place, Chicago, Ill., occupying its own building, which is 100 feet by 150 feet and seven stories high. The club originally had an isolated plant, which had been in service about twenty years and had been outgrown. At the time of reconstructing a large part of the building a few years ago, the plant was dismantled, and current was purchased from the Edison Company for a period of about two years. A new plant was installed and put into service last September.

The installation of a plant offered some difficulties, owing to the fact that the club service requires high-pressure steam at all times. It was accordingly necessary to install the new boilers with their auxiliaries complete and to connect them with the old stack and with the old piping without interruption of service.



View in Engine Room of the Union League Club, Chicago, Ill.

The boiler room contains three Babcock & Wilcox boilers, each of 150-horse-power capacity. Two of these boilers are capable of carrying the load of the plant. One boiler can be forced to carry the total load in case of emergency. The boiler room extends to the alley line of the building and the boiler fronts face the openings in the building wall at which coal is received. There is no coal-handling machinery, the coal being taken directly from the bins and fired on rocking grates in a furnace which is a modification of the standard installation with special baffling designed to avoid smoke.

The boiler room contains a single-cylinder feed-pump of the outside centre-packed type, a reserve feed-pump of the ordinary duplex type, and a bilge pump draining the deep portions of the building occupied by the boilers, including the blow-off water, drips from floor drains, water from boiler washing, etc.

The engine room also contains a vertical steam-driven ammonia compressor and a Yeomans centrifugal house pump direct-connected to a motor and supplying a roof tank at approximately 120 feet elevation, operated by a float switch. There is a steam fire-pump used also as reserve for the house-pump, and a motor-driven rotary blower operating pneumatic tubes.

The service of the plant includes supplying lights throughout the building, the operation of three electric passenger elevators and one freight elevator, the ventilation of the kitchens, toilet rooms, etc., for furnishing power for the various small motors used about the building. The steam load on the plant includes supply of live steam to a kitchen on the fifth floor and to the grill room on the second floor. This is not an inconsiderable part of the boiler load. Exhaust steam is used for heating the building and for furnishing hot water.

Ashes are shoveled into large cans, which are lifted to the alley grade by

means of a Sprague electric hoist running on a suspended track.

The heater room contains a Cochrane open feed-water heater and receiver, two closed heaters for supplying domestic water, a small air-compressor, and the machinery belonging to the vacuum cleaning system.

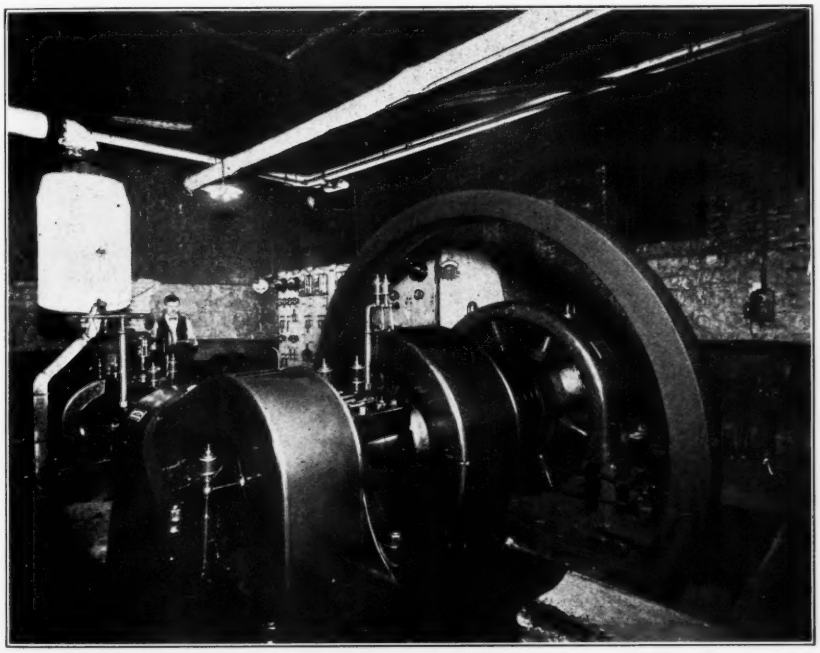
The electrical plant includes three units. One is a Fitchburg four-valve engine, with cylinders seventeen inches by twenty-four inches, operating a Western Electric generator of 150 kilowatts' capacity at 150 revolutions per minute. This machine is depended on to do the principal work of the plant.

The unit carrying the load from 1 A. M. to 7 A. M. is a Ball single-valve, twelve-inch by twelve-inch engine operating a Western Electric fifty-kilowatt generator at 280 revolutions per minute. There is a reserve engine with cylinder thirteen inches by fourteen inches of similar type operating a seventy-five-kilowatt generator. All generators furnish current at 250 volts, handling the building on a three-wire system with two Western Electric compensator sets.

The steam piping is provided with extra heavy screwed cast-iron fittings and valves with a rather liberal use of pipe bends on account of the shape of the space occupied by the plant, which, on account of building limitations, is long and narrow. The boilers are equipped with Foster non-return valves and the engines with Cochrane receiver separators. The piping was designed by the consulting engineers and installed by L. H. Prentice Company.

As the plant operates twenty-four hours a day and no interruptions of service can be permitted for any reason, there is an auxiliary header connected to independent boiler nozzles, which can in case of repairs to the main header keep the essential machinery of the plant in operation. All piping is covered with magnesia insulation.

The switchboard and wiring were provided by Kohler Brothers. The switchboard contains Weston indicating meters and General Electric wattmeters. The generators are connected through I-T-E circuit-breakers of the "Dalite" type, which have proved very successful in handling the sudden current rushes caused by the elevators. The machines are provided with double-pole switches, the equalizer cables running direct from machine to machine, with equalizer switches on the terminal boards.



MAIN ENGINE AND SWITCHBOARD, UNION LEAGUE CLUB PLANT, CHICAGO, ILL.

The plant was designed by W. L. Fergus & Company, consulting engineers, acting for the Property Committee of the Union League Club.

Pennsylvania Electric Association.

A movement toward forming an association of electric light companies in the state of Pennsylvania was started last fall by L. H. Conklin, general superintendent of the West Penn Electric Company, headquarters at Connellsville, Pa., with a circular letter to all the companies in the state, asking if such an organization would be desirable. The number of replies received was encouraging, and a "follow-up" system was inaugurated to interest companies in the organization of such an association. A meeting was called at Harrisburg, January 15, but only those companies were asked which had responded favorably to the circulars sent out. This resulted in ten companies sending representatives, and as this was thought so small a percentage of the companies of the state, it was not deemed wise to organize a permanent organization with such a small representation; therefore, a temporary organization was effected, and officers elected until such time as the executive committee deemed it wise to call another meeting for the purpose of a permanent organization. At that meeting the temporary officers were to vacate and the permanent officers be elected in their stead for a period of one year. Since that time a systematic effort has been made to interest the companies in this association, and the results have been remarkably good.

Realizing the fact that the matter of associations has been rather overdone, it was deemed advisable to follow this up with explanations of the reasons why a state association was of more particular benefit than a general association, due to the fact that it deals with local conditions, all having to figure on the same laws and legislative body, together with many other reasons, not the least of which is the social enjoyment of knowing one's neighbors. The results of this campaign, which has been carried on somewhat intermittently, has been that there are at present twenty-three member companies regularly enrolled and at least a dozen others who have signified their intention of joining. Among the companies enrolled are the largest in the state and also some of the smaller. The idea seems to be well received and the chances for success are very bright.

The meeting for the permanent organization will probably be called some time during the coming summer, at which time, it is fully expected, at least fifty companies will have enrolled.

The officers of the temporary organization are as follows: President, L. H. Conklin; vice-president, E. F. McCabe; secretary and treasurer, E. L. Smith; executive committee, E. H. Davis and A. R. Granger.

THE NEW INCANDESCENT LAMPS.[1]

BY FRANCIS W. WILLCOX.

TANTALUM LAMP.

The tantalum lamp was the first metal-filament lamp to dispute the supremacy of the ordinary carbon lamp. With the excellent efficiency of two watts per candle the lamp was a material improvement over the ordinary carbon lamp, which requires 3.5 watts per candle for the same life as the tantalum (on direct current), giving a saving with the tantalum lamp of over forty per cent for the same illumination, or, as the tantalum lamp is not made less than twenty candle-power, a saving of about thirty per cent over the ordinary sixteen-candle-power lamp. This material gain in economy has given the lamp a good start in commercial lighting, and over 1,200,000 of the lamps have been sold in this country. The lamp would have had a wider use but for certain limiting conditions.

In the first place, the tantalum lamp reached its development a little late, coming as it did at the time of the introduction of the Gem or metalized filament, which gave an efficiency of about 2.5 watts per candle at a cost of but twenty-five per cent more than the ordinary carbon lamp, where the tantalum lamp cost three times as much as the carbon lamp.

Secondly, the reduced life on alternating current (about half of that on direct current at ordinary frequencies, sixty cycles or less) practically limited the lamp to direct-current service, and this seriously restricted its field of application on central station service, in which alternating current is used for the most part. (Out of 4,000 central stations in this country less than 300 by number have direct-current service; about forty per cent by quantity of lamps.)

Further, the relatively high cost of the lamp (about three times that of the carbon lamp) made it impossible for central stations to supply free renewals of the lamp as is customary for carbon lamps.

In spite of these limiting conditions the tantalum lamp has been quite extensively employed in this country since its introduction a year and a half ago. Most of the lamps have been the fifty-watt (twenty-five candle-power) and forty-watt (twenty candle-power) sizes. An eighty-watt size is also made, which is used as an incandescent unit with the No. 2 size Holophanes. The forty-watt and eighty-watt are also supplied in the Meridian bulbs.

The lamps have taken best in central station service where the central station does not supply free renewals of carbon lamps, and customers being accustomed to buying their lamps will more readily purchase and try the tantalum. There are, however, relatively few of the direct-current central stations which charge for renewals of carbon lamps.

The average life on direct-current service runs well beyond the guaranteed figure of 700 hours, with many lamps lasting for 1,200 hours and more. The life on alternating-current service, as is well known, is below the direct-current life. The alternating-current life varies with the frequency.

The forty-watt tantalum lamp is naturally the most popular size, since the lamp saves ten watts (one kilowatt-hour for every 100 hours of service) over the ordinary fifty-watt carbon lamp, and thus saves its added cost in 400 to 500 hours of service rates.

Considering its economy, brilliant quality of light and present excellent life performance on direct current, the lamp should have a wider use.

What effect the introduction of the tungsten will have on the tantalum only time can tell. At present, appearances are that it will help to extend the use of the tatanlum lamp in the smaller sizes. The tantalum lamp will form a good adjunct to the tungsten, as it is a more hardy lamp, cheaper and more adaptable to the ordinary socket installations. It will, probably, therefore, share in the increased demand for high-efficiency lamps created by the tungsten lamp and be used as a supplement to the tungsten in locations where it would not be desirable or practical to employ the latter.

A large part of the tantalum-lamp installations has been on isolated plants. Its most successful service has been given on such plants in relieving overloaded apparatus and giving additional illumination without any increase of plant.

A successful example of its use in central station work is to be found at Muncie, Ind., a city of 30,000 inhabitants. Provided with an abundant supply of natural gas distributed by five or more separate companies and with a widespread use of individual gasolene plants, the electric company has found the use of tantalum lamps a great aid in increasing and holding its customers. Over 10,000 fifty-watt, twenty-five-candle-power tantalum lamps have been put into service out of a total of 32,000 sixteen-candle-power lamp equivalents connected. Every tantalum lamp was sold at sixty cents each as compared to carbon lamps at fifteen cents.

About one-half of the tantalum lamps installed are used on a flat-rate basis under a two-year contract. The rate of sixty cents per month for each fifty watts connected yields an annual income of $144 per kilowatt connected. The use of the tantalum lamp in conjunction with an aggressive campaign for business has assisted to increase the connected incandescent lighting demand twenty-three per cent for the last year in face of most severe competition.

TUNGSTEN LAMP.

Metallic conductivity is generally high, and to obtain the necessary resistance with tungsten for 100 to 125-volt lamps, long and very thin filaments are required. As such filaments are somewhat delicate and soften when burning, it is necessary to provide special methods of supporting the filament. The General Electric Company supports its filaments in the lamps with a special and clever form of anchor which permits burning the lamps in any position.

Our company in the last few months has shipped over 75,000 tungsten lamps to all parts of the country with positive and direct information from most of the package as to breakage. The results show an average of not exceeding one and one-half per cent breakage, which compares favorably with breakage on ordinary lamps.

A point of value occurs here. It is found that tungsten filaments while burning can not readily be broken; so if customers will keep lamps lighted while cleaning lamp, globe or fixture, lamp breakage will be minimized.

As is well known, the multiple tungsten lamps are now being made in this country in forty-watt, sixty-watt and 100-watt sizes, and so far over 200,000 of such American-made lamps have been made and sold. The probable supply of such lamps for the ensuing twelve months will be from 3,000,000 to 5,000,000 lamps. This will be enough to enable the central stations of the country to displace some gas arcs and take on additional business.

The tungsten lamp is used to the best advantage with the bowl form of Holophane reflector, particularly with the frosted type, which gives a very soft and agreeable lighting effect. From such a unit combination it is possible to obtain an illumination of four foot-candles per

[1] Abstract of a paper read before the Iowa Electrical Association, Des Moines, April 22, 1908.

watt per square foot upon a plane ten to twelve feet below the lamps, which is fourfold better than the average result from ordinary lamps and shades.

It must be realized that the tungsten lamp is a radically different proposition in many respects. It is not a lamp to replace ordinary lamps everywhere, as it is too large a candle-power and too brilliant. It requires to be used in a somewhat more special way—above the line of vision, or, in any event, suitably enclosed in frosted or opal globes, or shaded so as to avoid glare.

We have in the tungsten lamp a wholly new condition, as by reason of its very high efficiency we are no longer required to depend upon the nearness of the illuminant, but can flood a room or shop with a daylight brilliancy at reasonable costs with lamps placed well above the view. Enclosed globes and spheres can now be economically illuminated to a full and satisfactory brilliancy. All previous limitations are removed, opening up a new era of daylight illumination.

CENTRAL STATION POLICY.

Improvements in lamps heretofore have indicated progress, but the tungsten lamp means a revolution in the lighting industry. Its effect will be more far-reaching than even that of the Welsbach mantle. Can there be any central station manager indifferent or antagonistic to the adoption of the tungsten lamp? If so, let him consider how he would like to be denied its use while a competing company were to employ it. What would have happened to gas lighting had there been no Welsbach light? It is not whether electric companies want the tungsten lamp, but what would become of them if they could not and did not get it? Many companies are too prone to consider only the possible effect on business in hand (generally under twenty-five per cent of the entire lighting employed) and not look to the possibilities for new business to be reaped from the seventy-five per cent or more lighting done by other illuminants.

Now the tungsten lamp can and should be employed primarily to secure new business. Let every central station take the tungsten lamp and go after the fellows they have never been able to wean away from gas or oil, or who have gone back to gas or oil. Let your old customers know you have the tungsten lamp and that they get them at a price, but push them with the unsecured fellows and see the result. It is not necessary to do anything more than put the lamps in; they will talk for themselves far more eloquently than any one else can for them, and you can count on holding the business. The lamps will never be ordered out.

In other words, if you will try the "pay-after-you-have-tried-them" plan (instead of the "pay-as-you-enter," the new street-car programme), you will find that you can introduce as many lamps as you can obtain from the manufacturers and hold business permanently with them. The central station supply policy on lamps should therefore aim to make the stock of lamps obtainable available chiefly for developing new business. To this end a price should be made on the lamps which will not cause the old customers to take them up too rapidly, but will leave most of the lamps available for use in securing new customers.

Experience in electric-lighting service has shown that it has been a desirable policy for central stations to have as complete control and direction over the lamps used on their circuits as it is possible to obtain. Complete control has been obtained by the free-renewal policy, which policy has quite generally prevailed with central station companies in this country. While the same principles considered desirable with the carbon lamps apply, the writer believes, to the new lamps, the relatively higher price of the new makes it impossible to supply them on the free-renewal basis, and it is necessary for central stations to make a charge to cover at least the additional cost of such lamps.

Along this line of policy, therefore, it might be desirable to supply the lamps at a lower figure than they could be purchased by customers in the open market, but at a conservative figure, erring rather on the side of a safe cost than too low a price, in view of the relative limited output of such lamps and the desirability of utilizing them chiefly for obtaining new business instead of creating too great demand from present installations. The relative greater fragility of the tungsten lamps and the danger of breakage are deemed by some sufficient cause for charging the full list price for the lamps on the assumption that central stations must, for business policy reasons, guarantee every individual lamp's performance—something that the manufacturer can not, of course, attempt to do.

Several companies have adopted the plan of furnishing the lamps with direct charge to the customer by making a monthly maintenance charge per lamp therefor, after the plan that has been followed for years by gas companies with gas "arcs" and also with the Nernst lamps.

A fair monthly charge for the 100-watt tungsten lamp for an average use of two to four hours per day would be twenty-five cents per lamp per month, and in many cases it might be desirable to have the supply and maintenance of these lamps undertaken by a separate company controlled by the lighting company, so that the collection of the charges for maintenance would not be involved with the central station company's account for current.

In view of the fact that the relative price of the forty-watt and sixty-watt lamps is higher in proportion to their candle-power and income than the 100-watt tungsten, it might be justifiable to charge the same price, say $1.50 each for the three lamps, offering the customer the option of any size desired, and as the customer would rather obtain the most for his money, this might tend to create a demand for the larger and higher wattage lamp, which would be desirable from the central station viewpoint, which is to induce customers to increase the amount of light for the same wattage rather than decrease consumption by using lower wattage lamps.

Table I shows the saving secured for equal candle-power by the tungsten lamp. It shows the rates at which any one of these new tungsten lamps will pay their full cost or additional cost over equivalent candle-power of carbon filament in a given term of service, 1,000 hours. It will be noted that the 100-watt tungsten will pay its full cost in this time at a rate of one cent per kilowatt-hour and its additional cost at any rate over one-half cent per kilowatt-hour. The forty-watt lamp pays its full cost at any rate over two and one-half cents per kilowatt-hour. For ordinary central station rates, therefore, these lamps will justify their full cost and save their full cost several times over for equal illumination.

A word here as to the suggestion that the tungsten lamp be used at a lower efficiency to secure a materially longer life and thereby permit reduced costs or free renewals thereon. The necessary life for the 100-watt tungsten lamp to reduce the cost to that of the present carbon-lamp costs, runs 3,000 hours, and for the forty-watt lamp, 7,500 hours. It should be unnecessary to point out that such lives are wholly impracticable. The ordinary use of lamps of two to three hours a day means a year's service with 1,000 hours' life, and this is about the limit of prac-

tical lamp life on which to consider renewal costs, etc.

Any longer life than a year introduces a continually increasing hazard of mechanical breakage under ordinary conditions of service from handling, cleaning, etc. In any event, the special character of the tungsten lamp and its fragility render it easily possible for consumers either maliciously or carelessly to increase the breakage on the lamps to such an extent as to heavily increase the renewal cost to central stations attempting to supply such lamps on free-renewal basis.

It would seem from these considerations that it is wholly impracticable to attempt free renewals through the plan of increasing the life.

The life of the tungsten lamp operated or handled with reasonable care is so good at regular rated efficiency of one and one-quarter watts per candle that it is unnecessary to vary the rating thereon, as such variations tend to reduce the brilliancy and candle-power of the lamp and mar one of its chief advantages and attractions.

Table II gives some data on the various new lamps, including the tungsten, and will repay careful study. In table III is shown the cost to a consumer of a candle-hour of light at various rates per kilowatt-hour, including cost of power and lamp renewals.

TABLE III—COST PER CANDLE TO CONSUMER FOR VARIOUS LAMPS.

Rates per Kw.-Hour in Cents.	Total Cost of Lamps and Power per 100 Candle-Hours.			
	32-C. P. 100-Watt Carbon.	40-C. P. 100-Watt Gem.	20-C. P. 40-Watt Tantalum.	80-C. P 100-Watt Tungsten.
1.....	0.51	0.43	0.567	0.416
2.....	0.85	0.70	0.784	0.552
3.....	1.19	0.97	1.001	0.688
4.....	1.53	1.24	1.218	0.824
5.....	1.87	1.51	1.435	0.96
6.....	2.21	1.78	1.652	1.096
7.....	2.55	2.05	1.869	1.232
8.....	2.89	2.32	2.086	1.368
9.....	3.23	2.59	2.303	1.504
10.....	3.57	2.86	2.520	1.64
11.....	3.91	3.13	2.731	1.776
12.....	4.25	3.40	2.954	1.912
13.....	4.59	3.67	3.171	2.05
14.....	4.93	3.94	3.388	2.184
15.....	5.27	4.21	3.605	2.32

A substantial saving per lamp can therefore be shown for the tungsten lamp over the carbon. It is to be expected, therefore, that the tungsten lamp will promptly replace all other forms of electric lamps for street lighting. A recent installation of these lamps at Adel, Iowa, has given the following comparison of saving to be secured:

TABLE I—COST OF LIGHTING BY TUNGSTEN LAMP FOR 1,000 HOURS OF SERVICE.
SAVING IN COST OF CURRENT AT VARIOUS KILOWATT-HOUR RATES.

Rates in Cents per Kilowatt-Hour.	With 32-C. P., 40 Watt Tungsten.		With 48-C. P., 60-Watt Tungsten.			With 80-C. P., 100-Watt Tungsten.		
	Over 32 C. P. Carbon 3.6 W. P. C.	Over 32 C. P. Carbon 3.1 W. P. C.	Over 50 C. P. Carbon 3.6 W. P. C.	Over 50 C. P. Carbon 3.1 W. P. C.	Over 50 C. P. 125-Watt Gem.	Over 5 16-C. P. Carbon 3.5 W. P. C.	Over 5 16-C. P. Carbon 3.1 W. P. C.	Over 75 C. P. 187 Watt Gem.
1.....	0.74	0.59	1.21	0.95	0.65	1.80	1.50	0.87
2.....	1.48	1.18	2.43	1.90	1.30	3.60	3.00	1.75
3.....	2.22	1.78	3.64	2.85	1.95	5.40	4.50	2.62
4.....	2.97	2.37	4.86	3.80	2.60	7.20	6.00	3.50
5.....	3.71	2.96	6.07	4.75	3.25	9.00	7.50	4.37
6.....	4.45	3.55	7.29	5.70	3.90	10.80	9.00	5.25
7.....	5.20	4.14	8.50	6.65	4.55	12.60	10.50	6.12
8.....	5.93	4.74	9.72	7.60	5.20	14.40	12.00	7.00
10.....	7.42	5.92	12.15	9.50	6.50	18.00	15.00	8.75
11.....	8.16	6.51	13.36	10.45	7.15	19.80	16.50	9.62
12.....	8.91	7.10	14.58	11.40	7.80	21.60	18.00	10.50

TABLE II—GENERAL DATA AND COSTS OF LAMPS AND SERVICE.

	16-C. P. 50-Watt Carbon.	16-C. P. 56-Watt Carbon.	32-C. P. 100-Watt Carbon.	20-C. P. 50-Watt Gem.	40-C. P. 100-Watt Gem.	20-C. P. 40-Watt Tantalum.	32-C. P. 40-Watt Tungsten.	48-C. P. 60-Watt Tungsten.	80-C. P. 100-Watt Tungsten.
Total watts.....	50	56	100	50	100	40	40	60	100
Hour life to 80 per cent of candle-power.	500	1,000	500	500	500	800	800	800	800
Cost of lamp.....	17c	17c	25.5c	21.25c	29.75c	51c	$1.22½	$1.43¾	$1.70
Kilowatt-hours during life.....	25	56	50	25	50	32	32	48	80
Cost of renewals per kilowatt-hour.....	0.68c	0.30c	0.51c	0.85c	0.595c	1.6c	3.83c	3.0c	2.11c
Cost per 100 hours of service for power at 10 cents per kilowatt-hour.....	50c	56c	$1.00	50c	$1.00	40c	40c	60c	$1.00
Total cost of power and lamps per 100 hours service.....	53.4c	57.7c	54¼c	54¼c	$1.07	46.4c	55.3c	78.5c	$1.21
Candle-hours during life.....	7,350	14,700	14,720	9,200	18,400	14,720	23,680	35,520	60,000
Cost of power per 100 candle-hours at 10 cents per kilowatt-hour.....	3.4c	3.8c	3.4c	2.7c	2.7c	2.17c	1.36c	1.36c	1.36c
Cost of renewals per 100 candle-hours...	0.23c	0.12c	0.17c	0.23c	0.16c	0.35c	0.50c	0.41c	0.28c
Total cost power and lamps per 100 candle-hours (at 10 cents per kilowatt-hour for power).....	3.63c	3.92c	3.57c	2.93c	2.86c	2.52c	1.86c	1.77c	1.64c

The tungsten street series lamp is of equal, if not greater, value than the tungsten multiple lamp in providing profitable business for central station companies. These lamps, as is well known, are listed in 32, 40 and 60 candle-power, and the amperes range from 4 to 7.5 amperes at an efficiency of one and one-quarter watts per candle. One of the eastern central station companies has obtained in service test a life of 1,350 hours on these lamps. On the basis of 4,000 hours' service per year this would only call for three renewals.

This company installed a constant-current transformer of 8.8 kilowatts and 5.5 amperes complete with switchboard panel, with a circuit of eighty-two forty-candle-power tungsten lamps supplied therefrom. These replace a lighting installation of eighty-two thirty-two-candle-power multiple carbon lamps. The saving this customer makes the first year in energy will pay for the installation of the new apparatus and still show a net saving of over $115. The second year the saving will be over $413. This saving is obtained on the basis of three cents per kilowatt-hour and three renewals of lamps per year.

The more interesting point is the comparison of street-lighting costs of tungsten lamps in competition with gas. The forty-candle-power tungsten lamp with its practically constantly maintained candle-power during life will match the regular Welsbach street lamp, which, while it claims an initial candle-power of sixty, declines so rapidly in candle-power that its average candle-power is no greater than the forty-candle-power tungsten lamp. The gas mantle, using three and one-half cubic feet of gas per hour, will burn 14,000 feet during a year's service of 4,000 hours, amounting to $14 at $1 per thousand, or $10.50 at seventy-five cents per thousand feet. Assuming the renewals of mantles in use, repair and attention to lamps as fixed to three cents per lamp per night (the figures used in recent Buffalo contract), the total cost per lamp will be $24.95, with gas at $1 per thousand, or $21.45 with gas at seventy-five cents per thousand. Assuming four renewals per year as a conservative figure for the tungsten lamp at a price of $1.27½ each, we have about $5 for the lamp-renewal cost for the tungsten. Deducting this from

the renewal cost of the gas mantles of $10.50 leaves an excess of $5.50 for the gas mantles for the year. Adding this excess to the cost for gas at $1 per thousand, $14, we have a total of $19.50 per lamp as the figure to be paid for power.

The forty-candle-power tungsten lamp consumes fifty watts, or, on the basis of 4,000 hours' service, 200 kilowatt-hours, so that dividing $19.50 by 200 kilowatt-hours we have a rate of nearly ten cents per kilowatt-hour which could be charged to meet the cost of gas. This rate, of course, is most remunerative for this class of service. Central stations could afford to make a materially lower rate than this and thus be able to effectually compete against Welsbach lamps for street lighting. Incandescent lamps for street lighting possess many advantages, as the small units of light distributed at frequent intervals secure a uniformity of distribution that insures much better and more agreeable illumination than can be obtained with large units of light spaced at considerable distances apart.

From this review of the lamp situation we can declare that central station companies have great cause for rejoicing over the new developments which have given them a lighting device of such efficiency and simplicity and low cost as will enable them to effectually compete on the basis of cost against gas and other illuminants. Electric lighting has held its own in spite of a serious handicap in cost, and now that it is able to compete on equal terms the limit of its use is only measured by the capacity of the central station company to supply the service.

Public Service Corporation of New Jersey Authorizes Big Mortgage.

The Public Service Corporation of New Jersey has authorized a mortgage covering all of its holdings which will provide a complete financial scheme for years to come. President Thomas N. McCarter gave out the following statement for publication last week:

"The board of directors of Public Service at their meeting held Tuesday afternoon, authorized the execution of a first mortgage upon all the property of the corporation, securing an issue of $50,000,000 at par of five per cent gold bonds, dated May 1, 1908. The mortgage is designed to provide a complete financial scheme for the company for years to come. It covers all the real estate of the company, the leases of gas and electric properties held by the company, and pledges as security thereunder all the shares and bonds of underlying companies owned by the corporation, running into a very large total.

"By the terms of the mortgage $3,725,000 at par of the bonds are to be forthwith delivered by the trustee to the corporation. This is to recoup the company for betterments recently made and contracted for.

"Seven million two hundred and fifty thousand dollars at par are reserved for retiring a like amount of collateral gold notes, dated November 1, 1904, which notes are secured by a pledge of collateral of underlying securities, which collateral upon the completion of the refunding of said notes, become primarily subject to this mortgage.

"Six million two hundred and fifty dollars at par of said bonds are reserved for retiring a like amount, or so many thereof as may not have been converted of the convertible notes of the company, dated April 16, 1906.

"The remainder of the total issue is reserved under most carefully restricted provisions for future betterments.

"After the delivery of the $3,725,000 at par of bonds directed to be delivered to the company simultaneously with the execution of the mortgage, no future bonds can be certified and delivered by the trustee unless there be delivered to the trustee a certificate verified by affidavit of the proper officers of the company, that so far as any portion of said issue up to $25,000,000 at par is concerned, the earnings from the leased properties mortgaged and the income from pledged securities for the twelve calendar months next preceding the date of the certificate, exceed by thirty-three and one-third per cent the interest on all the bonds issued to date under said mortgage, plus the interest on the bonds, the certification and delivery of which at the time is desired; and that so far as the issue of the remaining $25,000,000 at par of bonds is concerned, there must be delivered to the trustee a certificate, verified by affidavit of the proper officers of the company, that the earnings from the leased properties mortgaged and the income from pledged securities for the twelve calendar months next preceding the date of the certificate, exceed by fifty per cent the interest on all the bonds issued to date under said mortgage, plus the interest on the bonds, the certification and delivery of which at the time is desired.

"Not more than $25,000,000 at par of said bonds can be certified and delivered under the mortgage prior to January 1, 1911, and thereafter not more than $4,500,000 at par of said bonds can be issued in any one year for betterments, except that this last provision is cumulative; that is to say, if a lesser number of bonds is taken in one year, an excess number may be taken the following year, provided the average does not exceed $4,500,000 at par.

"The trustee under the mortgage is Fidelity Trust Company of Newark; the coupons on the bonds are payable at the office of said Fidelity Trust Company, or at the agency company in the city of New York.

"The bonds required to be delivered to the company simultaneously with the execution of the mortgage have all been sold by the company, together with a certain additional amount of bonds which it is expected will be certified and delivered during the ensuing year for additional betterments, so that the company's financing for this year is completed, and it is, therefore, not contemplated that any bonds secured by this mortgage will be offered to the public this year.

"The mortgage has been examined and approved by Richard V. Lindabury, of Newark, and John G. Johnson, of Philadelphia."

Philadelphia Founder's Day Celebration.

The 225th anniversary of the founding of the city government of Philadelphia, Pa., will be celebrated from October 4 to October 10. It is planned to have an industrial pageant on October 7, which will be the greatest that the world has ever witnessed. This parade will be in the nature of a moving street exhibition of the leading industries of the city. The Hon. John Wanamaker and W. S. P. Shields are the chairmen of the committees arranged for the pageant. Associated with them are the presidents of many of the largest manufacturing concerns and prominent business men of the city.

The tentative programme has been announced as follows: Sunday, October 4, Religious Day; Monday, October 5, Military Day; Tuesday, October 6, parade of police and fire departments of city and state; Wednesday, October 7, all-day industrial parade; Thursday, October 8, Naval Day; Friday, October 9, historic pageants; Saturday, October 10, Knights Templars' Day.

The headquarters of the executive committee is room 682 City Hall, Philadelphia, Pa.

The Wagner Electric Manufacturing Company.

An Illustrated Description of the Development of a Great Electrical Manufactory.

IN 1890, two young electrical engineers, H. A. Wagner and Ferdinand Schwedtmann, appreciating the opportunity for improving the alternating-current fan motor, began in a small shop, in a very small way, the manufacture of

THE WAGNER FACTORY IN 1890.

desk fans. The plant was located in a small store, an illustration of which is shown herewith.

Strict attention to business and a careful conservation of their energies, and good fortune in getting the repair work of a large central station soon attracted other capital toward them.

After having been in business a year, it very soon became apparent that additional capital was desirable; this was forthcoming, and in 1891 a larger plant was the result, marking the incorporation of Wagner Electric Manufacturing Company.

The central station whose repair work these men were handling was one of the foremost in developing alternating-current

THE WAGNER FACTORY IN 1893.

distribution, this company operating at that time the largest alternating-current central station in the United States, this form of distribution being somewhat in its infancy and the apparatus somewhat untried.

It was the repairing the transformers of this company that first indicated to the Wagner company the faults with which they were affected, and its research and development of this line of apparatus led the company into new lines of thought and new forms of construction, both mechanically and electrically. This naturally led up to transformers of their own particular design, and the introduction of the transformer department rapidly used up all the space made available in the 1891 enlargement (a three-story structure), which necessitated increasing the plant 200 per cent, at which time (1896) the building took the form shown in the illustration herewith.

The company was very successful; made money from the start, and received great impetus from the proper organization of factory and selling forces. The results of the work in the experimental department here began to be felt in the introduction

THE WAGNER FACTORY IN 1891.

of a successful single-phase motor. The success with which this motor was received made necessary the further addition to these buildings, as shown, in 1900.

In 1896 and 1897, the company further extended its line to the manufacture of direct-current motors and generators, and was very successful in marketing this product. This direct-current line, however, was soon crowded out, owing to the large demands made upon factory capacity by the company's older line of manufacture.

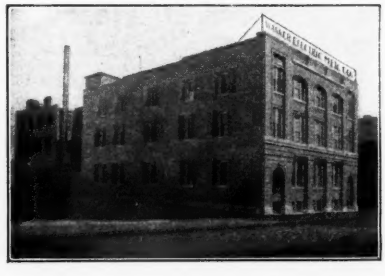
In 1896 several central station clients of the company enlisted its assistance in remodeling and improving their alternating-current switchboard meters, these instruments having proven both unreliable in operation and very fragile. This practically forced the Wagner company to design a line of such devices, and this line rapidly grew beyond its utmost expectations, and lent its part in compelling the company to provide an absolutely new plant for the proper handling of the business.

The old plant of the company, together with the adjacent ground, which was used for storage purposes, were outgrown three years before, when a careful search was

THE WAGNER FACTORY IN 1900.

made throughout the city of St. Louis and the surrounding country for a favorable factory site which would be suitable for the erection of an entirely new and modern plant.

The company's new plant is located at Hillside Station, and is about 800 feet west of the city limits. The site comprises about fifteen acres, and is admirably located as regards sunlight and fresh air, and has unsurpassed shipping facilities. In addition to this, it is located almost within a very excellent residence neighborhood, ground being obtainable for modest price, and homes at very reasonable figures. The surroundings are clean and free from all obnoxious industries.



THE WAGNER FACTORY IN 1896.

and the company believes that in a short time its employés will locate within easy walking distance of the plant.

A careful study was given to the first layout of the plant. The plan adopted is shown herewith, and it is believed that it will result in a minimum cost of manufacture together with opportunity for almost

indefinite expansion. The buildings and general layout, together with switch trackage and railroad facilities are clearly indicated in the diagram.

The materials are received at the north end of the plant and stored in the material warehouse called the rough stores building. All castings from the foundry will either be stored in this rough stores building or will pass through it en route to the work shops.

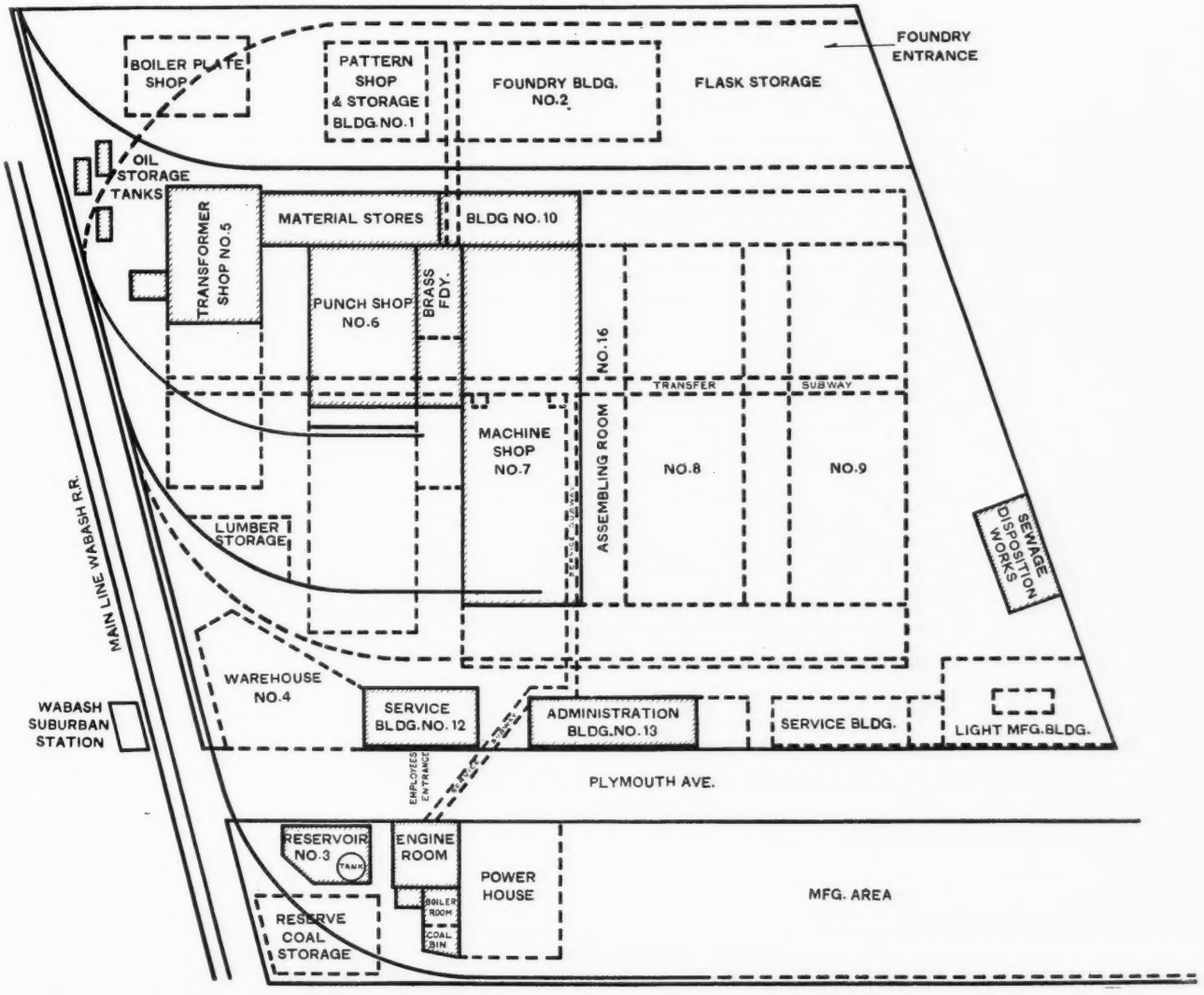
The several factory buildings are located at right angles to the rough stores building, the material for each building being carried in the stores building at such particular place as will insure its being loaded directly onto trucks running into the individual factory buildings. These factory buildings have been laid out as units in themselves, no partially completed product being transferred from one building to another for completion.

The entire layout is arranged so that as the business expands new factory units can be added and the work reclassed according to its type and size. It will be noticed that buildings No. 5 and No. 6 are arranged for easy expansion, which expansion will simply complete the general working plan as originally laid out. Buildings No. 7 and No. 8, when extended, will be connected by a transverse extension which will probably be used as an erecting shop.

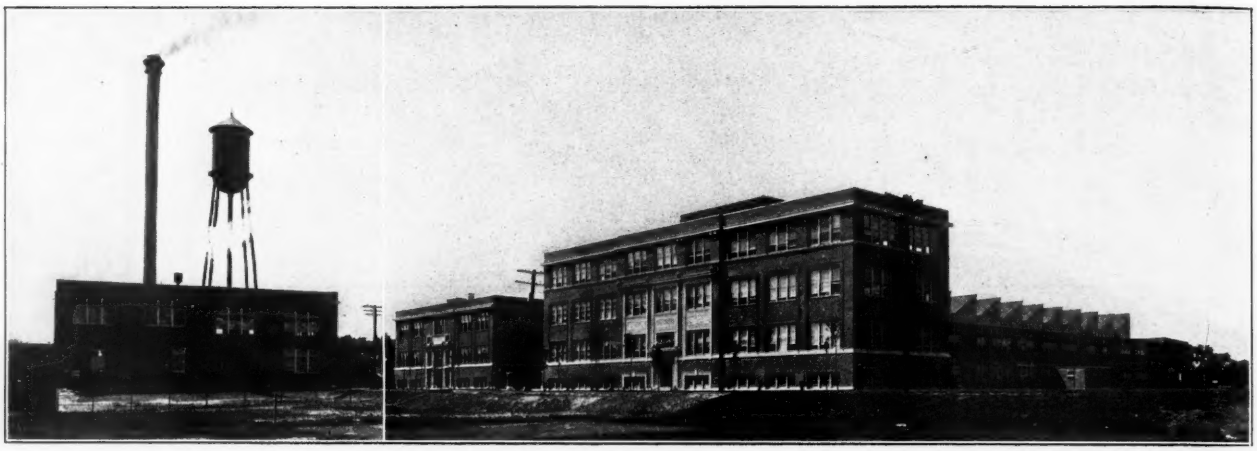
All of the buildings are served with traveling cranes operated with Wagner three-phase motors, and they are also fitted with hand cranes and air hoists to further the expeditious handling of material and finished product.

A particular feature which is producing great results in the layout of this plant is the system of concrete subways which connects the various buildings and departments. This system of subways is indicated in the diagram, and is served by elevators located at various points throughout the plant, the material being dropped down from the factory floor to the subway, there transferred to any department necessary, and raised by an elevator to the particular spot where it is wanted. This prevents crowding and trucking through the aisles, and the subways, together with the excellent crane service, keep the aisles practically free from material hauling and in a large measure obviate distracting the workman's attention from his individual task.

The subway is double-tracked, with



General Plan of Hillside Works, Wagner Electric Manufacturing Company, St. Louis, Mo. Solid Outline, Present Buildings; Dotted Lines, Future Extensions. Total Area, Fourteen Acres.



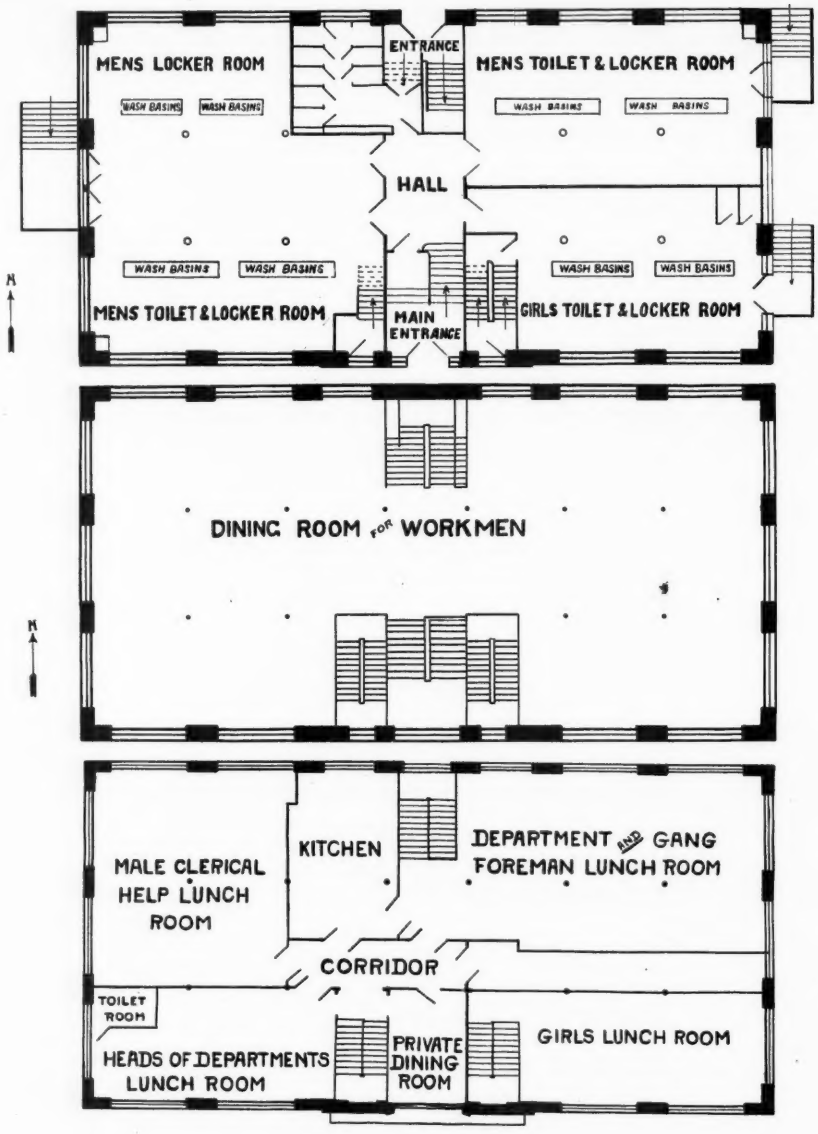
ADMINISTRATION, SERVICE AND POWER BUILDING, LOOKING FROM TENNIS COURTS.

turn-tables serving the elevators. There are frequent switchovers so that trucks may be sent from one track to the other as the occasion demands. The subway also serves to carry the various power and lighting feeders, together with the refrigerator and water supply. This subway is entirely of concrete form of construction.

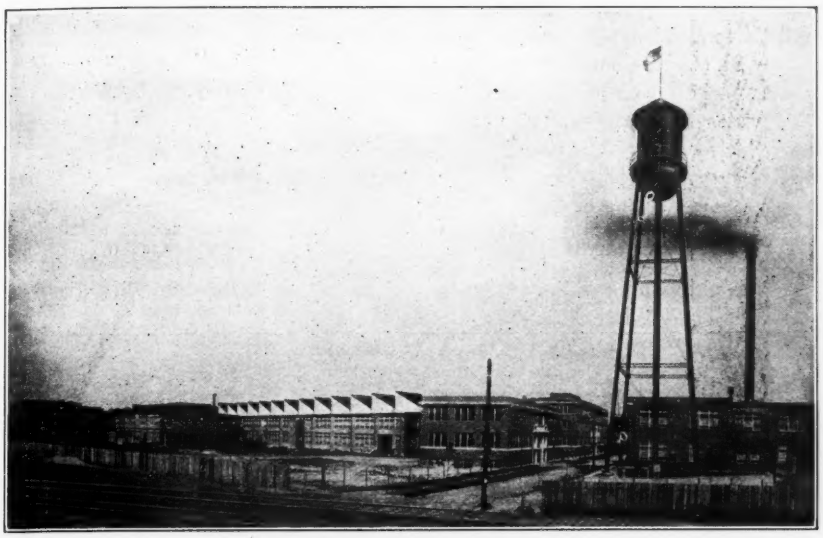
The general layout of the plant is shown very clearly in one of the views herewith, which includes the transformer building, the punch shop, main machine shop, service building, administration building, power-house, water tank and reservoir. The track shown in the foreground is the main line of the Wabash.

The buildings as shown on the plan are as follows: Power plant. One story, 100 feet by 90 feet. No. 5, transformer shop. Present portion 80 feet by 120 feet, having open erection bay on the west side throughout its length, with traveling crane service, and forty-foot gallery on the east side. No. 6, punch shop. Present length 90 feet by 144 feet, two stories; saw-tooth-roof construction. No. 7, motor shop. One hundred feet by 312 feet, having open central bay fifty feet wide, with traveling crane throughout its length, and side galleries twenty-five feet in width; saw-tooth-roof construction. No. 10, half of rough stores building. Present length 40 feet by 272 feet, two stories. No. 12, service building. Fifty feet by 100 feet, two stories and basement. No. 13, office building. Forty feet by 150 feet, three stories and basement; fireproof throughout.

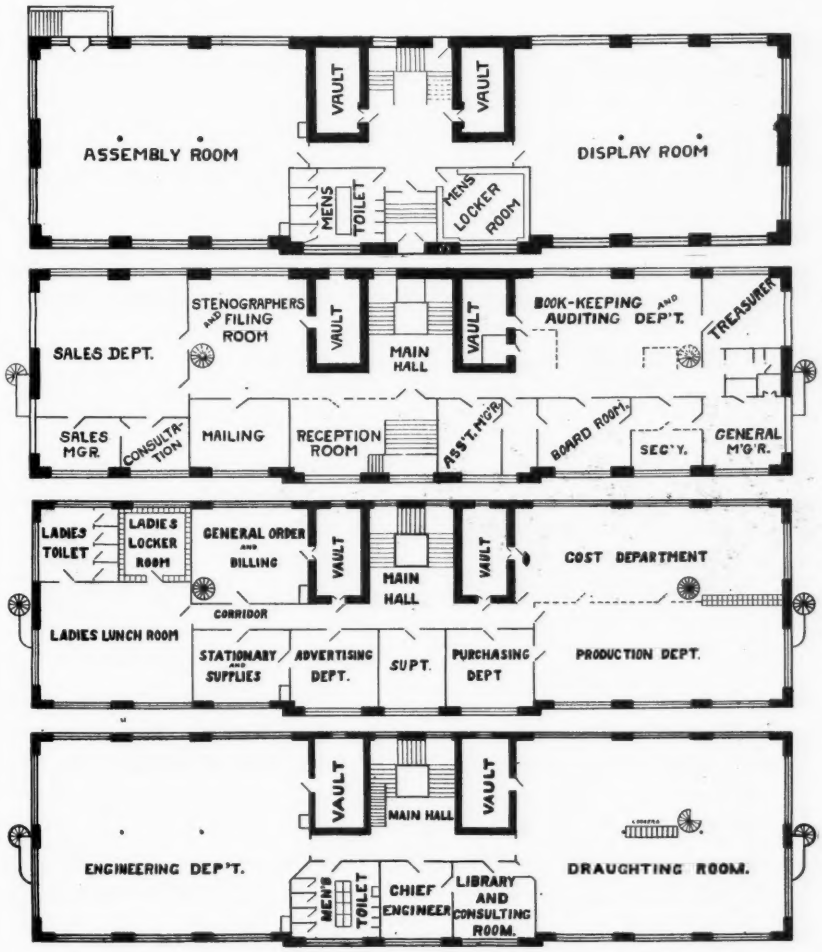
All these buildings have been designed for maximum light and free ventilation, and it is believed that no artificial light will be necessary throughout the entire



BASEMENT, FIRST AND SECOND FLOORS, SERVICE BUILDING, WAGNER ELECTRIC MANUFACTURING COMPANY, ST. LOUIS, MO.



View Looking East—Showing Transformer Building, Punch Shop, Motor Shop, Service and Administration Buildings, Power-House, Reservoir and Water Storage Tank. Wabash Tracks in the Foreground.

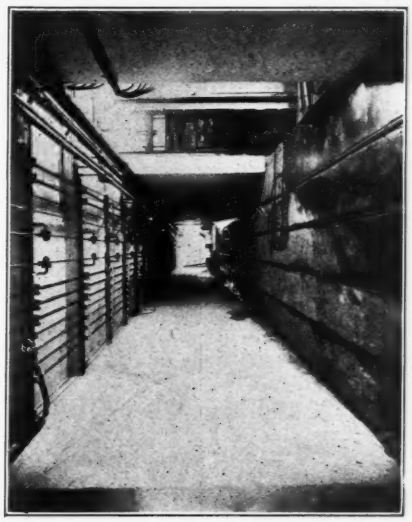


Basement, First, Second and Third Floors, Administration Building, Wagner Electric Manufacturing Company, St. Louis, Mo.

plant. All floors are surfaced with wood except the first story of the rough stores building, in portions of which wood is also used.

The heating system is hot water under forced circulation, with temperature controlled by the engineer at the power plant. The heating is graduated to the outside atmospheric conditions by manual regulation, by the engineer in charge. This heating installation is very complete, and is guaranteed by the manufacturers, the Evans-Almirall Company, to keep the buildings at seventy degrees.

An independent system of drinking water pipes is carried throughout the plant, and drinking water is supplied under a continuous circulation at a temperature of sixty degrees, this being maintained by a refrigerating machine driven by a Wagner single-phase motor. The temperature regulation of this machine is entirely automatic. Drinking fountains are located at sufficiently frequent and convenient points throughout all buildings to bring a supply to within fifty feet of every employé, the water coming up in a mushroom-shaped cup provided with a drain so that a workman may obtain a drink from a stream of water under pressure, without fear of contamination, as no cups are used, the stream of water only being brought in contact with the lips.



Transfer Subway Connecting Main Buildings.

Two drainage systems are provided. All surface water is carried direct into a branch of the River Des Peres, which runs along the east side of the factory tract. All sewage from the plant is carried through a septic tank which is shown on the plan, for reduction and purification,

and thereafter discharged into a branch of the River Des Peres.

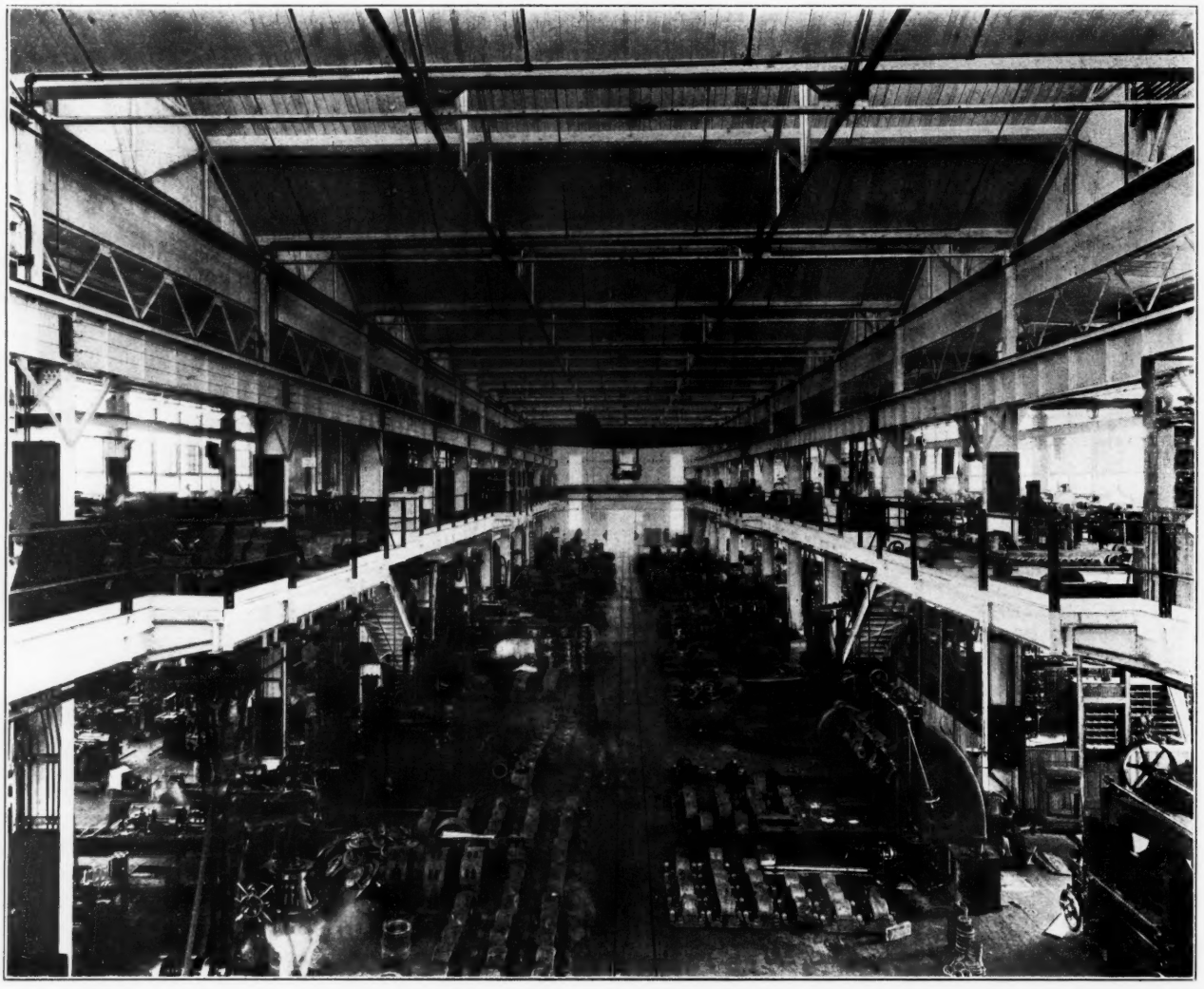
The equipment for fire protection consists of a 75,000-gallon steel tank, 100 feet in the air, located immediately over a 150,000 gallon surface storage reservoir, this reservoir being located adjacent to the power plant. A fire pump located in a pump-house adjacent to the reservoir is kept under steam at all times, for service, should a fire break out. The system of sprinkling plugs located throughout the grounds is very complete, each one being a twin-plug around which is built a small fire house. Each house is equipped with axes, lanterns, hose and nozzle for quick action. A fire department has been organized and drilled for service should a fire break out at any time during factory hours.

In addition to the fifteen twin-plug stations, the entire factory is equipped with an interior system of water pipes with sprinkler heads. The outside water supply to the fire pump consists of an eight-inch connection with service pipes from the St. Louis County Water Company, thereby insuring an adequate supply of water at high pressure at all times.

Believing that the best work could be obtained from factory employés if they had pleasant surroundings, a radical departure from previous practice was made at the new plant in providing a service building shown herewith. This is a three-story brick building, in the basement of which are located the lockers of all employés working in the factory, and a limited number of toilets (the main toilets being scattered through the buildings). The factory employés pass through the service building in entering the plant, making such change of clothing as they wish, each employé having at his disposal a steel locker, for which he alone has the key. Heating pipes are carried underneath these lockers for the purpose of drying out such clothing as may be damp when coming to work.

The employés are required to use the service building for lunch purposes, as ample lunch facilities have been provided on the second floor, each department being assigned tables where the employés may eat their lunches at their leisure. The company provides a light lunch, which is sold to the employés at cost, the purchase of which, however, is entirely optional. In the centre of this room is a serving counter from which milk, coffee, sandwiches, pies, etc., are served, the company furnishing all the china and tableware used in the service of the lunches.

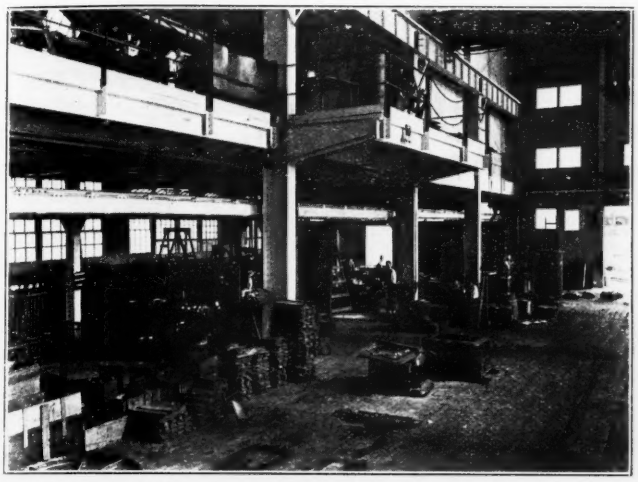
The second floor of the service building is divided into a number of lunch rooms, and a small kitchen is located therein, a simple lunch being provided at cost for all office and engineering department employés. There are five sections in the second story: One for factory foremen, one for male office clerks, one for executive



Machine Shop, Looking North.

department heads, and a small, private lunch room, where visitors may be entertained. There is also a general room for the factory girls.

It was deemed advisable to install the lunch feature of the service building for the double purpose of shortening the noon rest-hour to thirty minutes, permitting the men to get off duty thirty minutes earlier in the evening and to forestall the rapid encroachment of the lunch saloon, and also, to avoid the accumulation of lunch



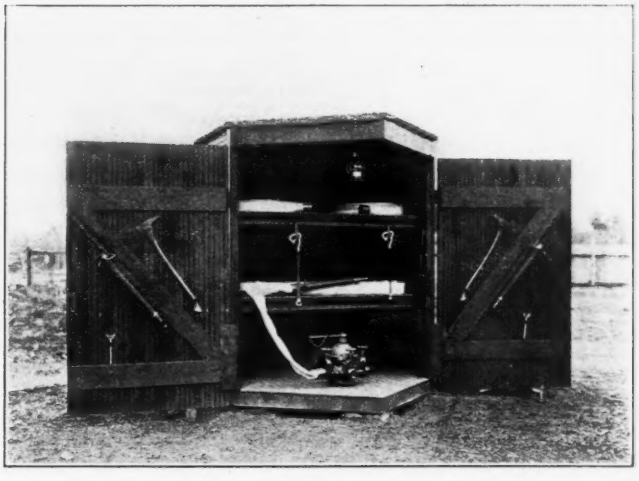
Transformer Shop, Showing Overhead Gallery Construction.

Second Floor of Punch Shop.

Yards, Looking Southeast.

Rough Stores Building, Showing Receiving Platforms.

Septic Tank.

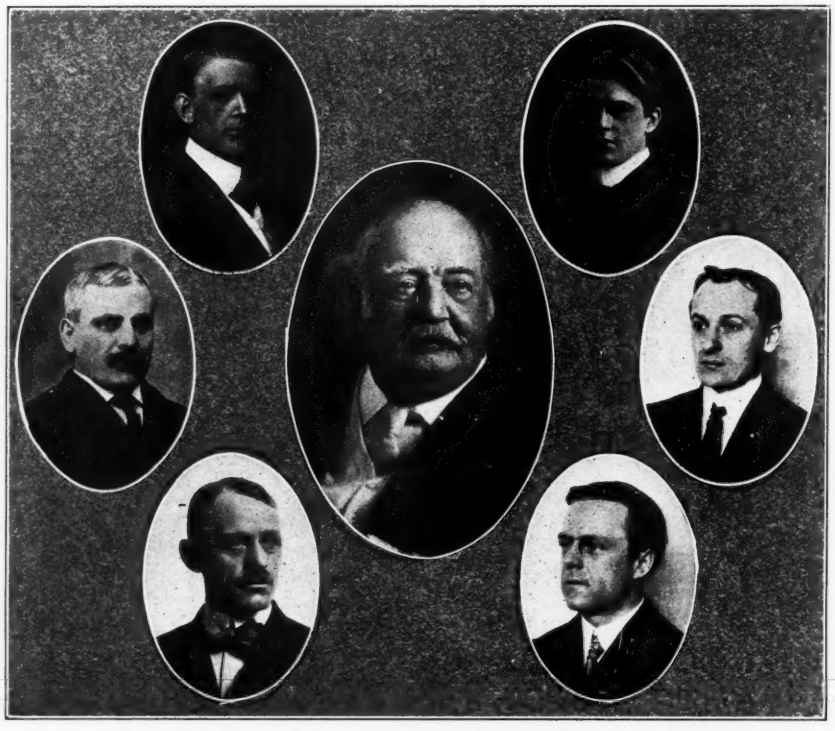


One of the Four Fire Houses.

refuse in the factory proper. This arrangement has succeeded admirably and meets with the hearty endorsement of the factory hands.

A feature to which attention should be called is the improvement brought about in the district by the factory. Before the company built on this site, Plymouth avenue, running in front of the works, was a cow path; at the present time it is a graded street with smooth surface, boulevarded on each side with grass plots and shade trees, and provided with cinder walks. This is a sixty-foot street with a twenty-five-foot road, leaving about seventeen and one-half feet available for sidewalks on each side.

One very interesting illustration herewith is a view looking down building No. 7. This is the main machine shop and it will be noted that this building carries a gallery on each side. The building is 100 by 312 feet, the galleries being twenty-five feet in the clear. The building has a sawtooth roof, the vertical panels facing the north. The building is served through its entire length by a ten-ton crane, operated by three-phase Wagner motors. The space underneath the galleries and the galleries proper are served by twenty-eight hand cranes, each one of which serves a limited area.



EXECUTIVE STAFF OF THE WAGNER ELECTRIC MANUFACTURING COMPANY.

W. A. LAYMAN, Vice President and General Manager.
W. S. THOMAS, Treasurer.
C. B. LORD, Superintendent.
S. M. DODD, President.
W. ROBBINS, Assistant General Manager.
A. H. TIMMERMAN, Chief Engineer.
V. W. BERGENTHAL, Assistant Sales Manager.

This shop is equipped with every facility known to the trade, in the way of modern machinery.

An interior view of a corner of the transformer-shop building, No. 5, is shown herewith. Here the heavy steel construction together with loading platforms, may be noted. The structure is arranged so that the overhead crane may serve the gallery. The heavy and large transformers are built on the main floor of this building, the coil winding and insulation processes being conducted in the gallery.

The interior arrangement of the instrument shop is also shown, this shop being on the second floor immediately over the punch shop.

The power building is equipped with the following apparatus:

One 250-kilowatt, three-phase, 440-volt, sixty-cycle, alternating-current generator, direct connected to a St. Louis Iron and Machine Company's tandem-compound Corliss engine; one 100-kilowatt, 133-cycle, single-phase, 110-volt alternator, for testing purposes; one fifty-kilowatt, 500-volt, direct-current generator for testing purposes.

The output is entirely controlled by Wagner switchboard indicating instruments, and measured by Sangamo integrating meters. The boiler-plant equipment consists of two Heine boilers with American chain-grate, driven by Wagner single-phase motors.

As the apparatus of the company steadily underwent complete evolution, so also did the active personnel of the staff. From a business of small proportions calling for limited capital and the personal attention only of its organizers, the corporation demanded and commanded the support of a strong coterie of St. Louis financiers on the financial side, and a larger staff of engineering and executive heads on the administration side. To-day the board of directors of the company is probably the most representative of any corporation in the city of St. Louis, comprising the active spirits of the city's foremost bankers. Among these are:

S. M. Dodd, capitalist, president, member of the board of National Bank of Commerce, Commonwealth Trust Company, and Mercantile Trust Company.

James W. Bell, member of the board of National Bank of Commerce, and member of the board and manager of savings department of the Mercantile Trust Company.

J. C. Van Blarcom, president National Bank of Commerce.

Thomas H. West, president St. Louis Union Trust Company.

James Campbell, capitalist, controlling spirit of numerous large corporations, including railways, mining properties and many others. President of the Telluride Power Transmission Company.

Albert Blair, secretary and counsel, director and attorney for numerous industrial companies.

W. A. Layman, vice-president and general manager.

The president of the company, who has piloted the financial interests of the corporation through its various stages of development, is one of St. Louis's pioneer business men. His name has been identified with all the foremost commercial movements of the city for fifty years. To his wise and conservative counsel may be largely attributed the record of the company's achievements. Mr. Dodd organized the first large alternating-current central station company in the West, the Missouri Edison Company, of St. Louis, for years the foremost example, west of New York, of a central station distribution by alter-

nating current. The business of the Missouri Edison Company first directed his attention to the manufacturing of electrical devices, and as the Wagner company expanded, he gathered around him the coterie of St. Louis financiers above mentioned, men who can bring to the Wagner company such financial support as it may at any time have occasion to wisely employ. Under their direction, the interests of the company may surely be expected to expand.

The engineering and administrative staff has undergone gradual evolution also. The directory heads have changed from time to time, active leaders in the business seeking other fields, until to-day the active organization rests largely upon men who have been developed in the company's own plant, all of whom are well known in electrical fields.

W. A. Layman, vice-president and general manager, is a graduate of the Rose Polytechnic Institute, having been graduated in 1892, taking the degree of B.S. In 1894 he was given the degree of M.S. In 1896, E.E. Mr. Layman is a full member of the American Institute of Electrical Engineers, and past president of the Engineering Club of St. Louis. He began his work with the Wagner Electric Manufacturing Company in September, 1892, as draftsman, serving successfully as the head of the engineering department, assistant superintendent, assistant manager, and as general manager of all departments since 1902. Mr. Layman was elected vice-president of the organization in 1908.

W. Robbins, assistant general manager, is a graduate of the University of Michigan, class of 1896, having taken the electrical engineering course. Immediately after his graduation he entered the organization of the Western Electric Company, of Chicago, Ill., having served in almost every capacity from salesman to superintendent of construction. He also served two years on the manufacturing committee of the Western Electric Company, leaving that company in July, 1906, to associate himself with the Wagner company, with headquarters in the main office at St. Louis.

W. S. Thomas, treasurer, is a graduate of the Illinois State University, having had fourteen years' experience as the manager and financial head of one of the largest wholesale coffee establishments in the West. Mr. Thomas's connection with the Wagner company dates from December, 1907.

A. H. Timmerman, chief engineer, is a graduate of the College of the City of New York. B.S. in 1891, afterwards graduating from Cornell University, M.E., in electrical engineering in 1892, taking degree of M.M.E. in 1892. Mr. Timmerman was instructor of physics and electrical engineering in 1893-94 in the Washington University of St. Louis, and was professor of physics and electrical engineering in the School of Mines and Metallurgy, University of Missouri, Rolla, Mo., from 1894 to 1899. In 1899 Mr. Timmerman entered the organization of the Wagner company as electrical engineer, being made assistant superintendent in 1900, and superintendent in 1902. Mr. Timmerman succeeded to the position of chief engineer in 1908.

C. B. Lord, superintendent, was associated for seven years with the General Electric Company as general foreman of the train-control department and test department. After leaving the General Electric Company, he served as assistant superintendent with the Victor Talking Machine Company, of Camden, N. J., associating himself with the Wagner company, December, 1906.

V. W. Bergenthal, assistant manager of sales, is a graduate of the University of Wisconsin, 1897, B.S.E., having taken a post-graduate course in 1898 with a degree of E.E. Mr. Bergenthal was associated with the Stanley-G. I. Electric Manufacturing Company for five years, in the engineering testing department, trouble department, and later as designing transformer engineer. Mr. Bergenthal was located with the Stanley company as Western sales engineer, with headquarters at the Chicago office, and later was made assistant manager of the Chicago office of this company. In the fall of 1903, Mr. Bergenthal associated himself with the American Automatic Switch and Signal Company, leaving that company to associate himself with the Wagner company in November, 1904.

Complimentary Dinner to Thomas F. Mullaney.

A few of the most intimate friends of Thomas F. Mullaney assembled at the Engineers' Club in New York on Wednesday evening, May 6, and gave him a complimentary dinner. Mr. Mullaney has just severed the business ties of more than twenty years with the General Electric Company to take the position of chief engineer of the Third Avenue Railroad of New York city. In the early days of the electrical business he was connected with the Thomson-Houston Electric Company, and later with the General Electric Company. From almost the first of his engineering career he has stood pre-eminent among construction and operating electrical engineers.

Probably no other engineer has had responsible charge of so many large and important installations in the electrical field as has Mr. Mullaney. For many years his work has been confined to New York city, where the largest installations of electrical machinery have been made under his direction. His other great successes in former years were at Chicago, St. Louis and Boston. His work in connection with the construction and operation of the early underground railway conduit systems was epoch-making in that most important phase of electrical and railroad development.

William J. Clark, of the General Electric Company, acted as toastmaster of the dinner, and in a most felicitous speech presented Mr. Mullaney with a handsome watch, chain and charm on behalf of his old associates in the General Electric Company. Mr. Mullaney's appreciation of this testimonial from his friends was gracefully expressed in a speech of thanks for such touching assurances of high regard, friendship and good wishes for the future.

The dinner was enlivened by many informal addresses, some of the most notable being those of Messrs. Maher, Lieb, Katte, Hirt, Doyle and Armstrong.

Among the guests were Edward A. Maher, general manager Third Avenue Railroad; John W. Lieb, general manager New York Edison Company; Edwin B. Katte, chief engineer electrical department New York Central Railroad; M. G. Starrett, consulting engineer New York City Railway Company; Louis Hirt, engineer Mexican Tramways and other foreign properties; J. S. Doyle, superintendent equipment Interborough Rapid Transit Company; J. R. C. Armstrong, electrical engineer New York City Railway; W. H. Sawyer, of Ford, Bacon & Davis; Alex. McIver, superintendent equipment New York City Railway; J. S. McWhirter, superintendent equipment Third Avenue Railroad.

Among those present from the General Electric Company were Hinsdill Parsons, vice-president; W. J. Clark, manager heavy traction department; W. B. Potter, chief engineer traction and railway departments; W. L. R. Emmet, engineer lighting department; T. Beran, manager New York office; J. J. Mahony, New York, and A. L. Rohrer, of Schenectady.

Mr. Mullaney has a host of friends throughout the world, whose good wishes go with him in assuming his new duties and responsibilities.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

Construction of Rheostats.

This article, dealing with the construction of rheostats, describes a water rheostat which, it is said, is free from the objections frequently attached to this type. These devices, after a short use, are apt to become leaky, and thus not only are dirty but unsafe. In this there is no hole in the side or base of the containing vessel. The leading-in wire for the lower electrode is carried down within the walls of the vessel. This electrode is a truncated cone over which the upper electrode, which is similar in shape, fits when it is lowered completely to the bottom. The whole device is placed on an insulating tray containing oil, and this prevents corrosion and electrolytic action.—*Abstracted from the Electrical Engineer (London), April 24.*

The Purchase of Coal on a Scientific Basis.

Fuel-users, as a class, are not scientific in their manner of purchasing coal, says J. B. C. Kershaw, and the methods which satisfied the manufacturers of the last generation are still in general use to-day. No other raw material of equal importance to the economic conduct of our industries is purchased with such an absence of effective means for checking the quality of the supplies. The usual method of selecting coal is also open to criticism, while the means taken to insure that deliveries of the selected coal shall be up to the standard of the sample car are ludicrously inefficient. It is not sufficient in purchasing coal to order several sample carloads from different dealers and burn these under the boilers and note the results. These samples may have been subjected to very different conditions as regards weather. The conditions in the boiler room may change and the results thus obtained not be any true indication of the respective values of the different supplies. Every one who has conducted boiler tests is familiar with the variations which may occur and which will yield different results. Further, the methods used for checking the quality of the deliveries under the contract with the dealer are also hopelessly inadequate. The method offered as a substitute for these lacks in practices is simply that used for testing and controlling the supplies of other raw materials, namely, chemical and laboratory tests carried out by chemists who have had experience in this class of work. In these tests it is usual to heat the sample to a certain temperature, about 230 degrees Fahrenheit, so as to dry off the moisture. It is then raised to a red heat in a closed crucible so as to drive off the hydrogen gases and sulphur. It is then heated with access of air so as to burn the remaining carbon, leaving the ash. This gives the moisture, the volatile contents, the fixed carbon, and the ash. It is also desirable, when convenient, to check the results obtained in this way by calorimeter tests. When such tests are made, it is a comparatively simple matter to determine which is the best or cheapest of a number of different fuels, and when this has been done it is also a simple matter to check the daily, or weekly, supply and penalize the seller when this does not come up to the contract. On the other hand, when the fuel is of a better grade, the seller will get the advantage of this, as well as the purchaser. The author closes by calling attention to the justice of this method, in which the consumer pays for the heat he obtains, and the deliverer is protected from unfair competition.—*Abstracted from Cassier's Magazine (New York), May.*

Measurement of Illumination.

An investigation has been made by K. Edgcumbe to determine whether the horizontal illumination forms the best criterion for outdoor lighting, as is generally held. Measurements were made by means of a portable photometer with a horizontal screen. The results show that with a good screen the agreement with the cosine law, even at the very smallest angles, is well within experimental error. It is also sought at the same time to determine how nearly the lighting of a street could be regarded as emanating from a point, or in other words, whether it was safe to calculate the horizontal illumination from a measurement of direct illumination. It was found that the calculated illuminations were not very different from that observed in open parks, except at large angles. But on streets, owing to the reflection from buildings, etc., the divergence is so great as to render it almost imperative to measure the horizontal illumination direct, rather than to attempt to determine it from candle-power or direct illumination measurements.—*Abstracted from the Electrical Review (London), April 24.*

Ionium, a New Radioactive Element.

From time to time notes have been published suggesting the existence of a new radioactive element intermediate between uranium and radium. One of the first investigators to call attention to this matter was B. B. Boltwood, who here gives a summary of the previous references to this material and the results of the latest attempts to separate it and determine its peculiarities. Actinium was identified in 1899, and shortly after that references were made to another material which apparently differed from those already identified, but the investigations were not sufficiently definite to make certain whether the observer had not obtained a quantity of the radioactive material already known. The fact, however, that there is a definite and constant proportion between the quantities of uranium and radium in minerals, which can only be explained by the assumption that radium is a disintegration product of uranium, coupled with the further fact that attempts to observe the growth of radium directly from purified uranium were unsuccessful, led to the conclusion that there must be some intermediate stage represented by another material which possibly was the same that had been observed but not identified. The author, therefore, made a systematic search for this intermediate product, employing for this purpose various minerals which were treated to extract the radium and actinium and other known radioactive substances. Six solutions were obtained, the activity of which was studied in various ways. The result of this investigation seems to be the identification of this intermediate product which has been called "ionium." This gives rise to alpha and beta rays, both of which have slight penetrating power. The activity is about seventy-five per cent of that of radium, and the half-value period, or the time required for half of a given quantity to be transformed into radium, is at

least twenty-five years. A sufficient quantity of the material was not secured to determine its chemical properties, but it is evidently similar to thorium.—*Abstracted from the American Journal of Science (New Haven), May.*

Compensation of Pressure Variations on Alternate-Current Networks Supplying Motors.

The system of alternate-current pressure regulation, which is described here by A. Heyland, is based upon a principle depending on the operation of one or more motors connected to the system. A simple application may consist of an induction motor driven from the system, which is started by means of a rheostat in the secondary circuit. When such a motor starts with a large torque, the current is a maximum at the start and diminishes until the rheostat is short-circuited. Moreover, the voltage drop in this network, caused by this motor, will be a maximum at starting and will decrease for normal working. It is, therefore, easy to couple together the starting resistance of the induction motor with the field rheostat of a synchronous motor connected to the same circuit, so that the two resistances will be varied inversely and the increased excitation of the synchronous machine will react upon the generator so as to compensate for the increased load due to the starting of the induction motor, and thus prevent the drop in voltage which would otherwise take place. Instead of connecting the resistances mechanically, these connections may be made in any other way, and the resistance in the field circuit of the synchronous machine may be regulated by a change in the speed of the induction motor or any property which is dependent upon the operation of this motor. Another application of this principle may be made by means of a motor generator, the object of which is to obtain economy in starting and regulation. In this case the alternating current motor is connected to the system and mechanically coupled to the direct-current generator which supplies the driving motor. The regulating resistances of the several machines may be grouped in various ways so as to compensate automatically for the voltage drop due to changes in load. An arrangement of this kind will be found suitable for use in installations where a high rate of acceleration, combined with a large torque, is required; that is to say, for motors for winding, haulage and other similar work, or in places where the load varies greatly, as in rolling mills. In such cases motor-generators are essential for another reason besides that of economical speed regulation, that is for compensating the effects of sudden temporary loads on the drop of pressure at the generating station, and its effects on other motors connected to the network. It is not sufficient merely to insert such a set in the motor circuit because the voltage-drop in the primary is not avoided at the time of sudden loads. The practice up to the present time has been to add a flywheel to the motor-generator set of sufficient dimensions to suppress these fluctuations in voltage and to take up the sudden loads. This use of a flywheel is somewhat inconvenient. The primary machine of the transformer group should be an induction motor whose speed may be regulated by the loss in the secondary resistance, giving a greater or less slip. On the other hand the flywheel should be of sufficient size so as not to reduce the efficiency of the group too much. This adds to the complication of this type of insulation and makes it difficult to start and stop the transforming group. In the system just proposed, the flywheel of this group may be entirely avoided if desired, or may be considerably smaller, since there is not the same need to smooth out the load so uniformly if the system itself automatically compensates for voltage changes. It may even be arranged to overcompensate so as to increase the voltage with the load, and the power factor may be kept high. The author then describes a number of groupings of machines in which this principle is utilized. These may be applied singly or simultaneously. All of these applications are characterized by the fact that the regulation of the alternating-current voltage is directly dependent upon the operation of one or more motors connected to the network.—*Abstracted from the Electrician (London), April 24.*

The Variation of Apparent Capacity of a Condenser with the Time of Discharge and the Variation of Capacity with Frequency in the Alternating-Current Measurements.

It has been known that the impedance offered by a condenser to the passage of an alternating current depends upon the frequency of the current. The capacity is larger for low frequencies than for high. The amount of this variation is not generally known. B. V. Hill has investigated this question, using for this purpose a number of mica and paper condensers of one and two microfarads' capacity. The measurements were made first by means of a ballistic galvanometer, and then with alternating currents of various frequencies. A special charging and discharging key was arranged, enabling settings to be made of one-six thousandth of a second. Using this key and the ballistic galvanometer, it was found that the mica condenser gave a discharge curve agreeing closely with the theoretical, assuming that the true capacity of this condenser was that given, one microfarad. One of the paper condensers, also, gave tolerably good discharge curves, although the absorption was very evident, but it was found that a galvanometer with a period of at least five seconds should be used even with the mica condenser, if the complete charge is to be liberated. The paper condenser just referred to was what is known as a "hard condenser," that is to say, one in which the sheets had been pressed together strongly. A second, or medium, condenser showed a greater absorption, while a soft condenser parted with only about half of its charge at the end of one-hundredth of a second, and was found to continue discharging for two minutes or more. For determining the capacity of the condensers by means of alternating currents it seemed best to compare their impedance with that caused by a known inductance. The coil used was a standard wound on marble. With this the effect of frequency upon the resistance of inductance, up to 3,000 cycles, was too small to be taken into account. The method employed was a modification of Anderson's method. The high frequencies were used in order to make the results applicable to telephone service. A small inductor alternator was employed for furnishing this current. No account was taken of the wave-form developed in this machine. It was found that the mica condenser and the hard paper condensers increased very slightly in capacity between sixteen and 125 cycles. The soft paper condensers fall off regularly in capacity up to the highest frequencies tried, the worst of these decreasing 2.55 per cent, an amount too small to be considered in telephone work. By comparing the two methods it would seem that a poor condenser, measured by the ballistic method and discharging in one-hundredth of a second, showed a capacity of only thirty-seven per cent of that obtained when allowed to discharge for the whole quarter period of the galvanometer. When tested with an alternating current in which the complete period of change was only .00008 second, the capacity was still eighty per cent of that obtained by the ballistic method with the complete quarter period of the galvanometer.—*Abstracted from the Physical Review (Lancaster), May.*

Methods of Getting New Business

A DEPARTMENT DEVOTED to the COMMERCIAL DEVELOPMENT of CENTRAL STATIONS

Managers are Invited to Contribute Suggestions for Methods of Increasing the Demand for Electric Service

Boosting Electricity in the Mahoning and Shenango Valley District.

In the district included in the Mahoning and Shenango valleys there are three cities—Youngstown, Ohio, and Sharon and New Castle, Pa., having a combined population of about 150,000 people, which considerable community is served by the Mahoning & Shenango Railway and Light Compar .

The commercial activity of this great company has been considerably accelerated since the consolidation effected several months ago and, under the influence of aggressive management and enterprise, good headway is being made in increasing the use of electricity for lighting, heating and power purposes.

This company employs, as the basis of its direct-by-mail campaign, a very excellent monthly bulletin, prepared and edited with a view to the local situation throughout. In each number are shown illustrations and articles regarding notable electric-lighting installations by the enterprising merchants of the three cities, and from time to time appear editorial talks which are certainly framed up to have a very excellent moral effect on the customers of the company and the public generally who receive the bulletins. Thirty-five hundred copies of the bulletin are mailed direct each month to a carefully compiled list of good customers and prospects in the three cities before mentioned.

As a supplement to this bulletin work, specialized advertising, consisting of attractive cards, folders, facsimile typewritten letters, booklets, novelties, etc., is sent each month to a selected list of power, sign and commercial lighting prospects, thus forming a very complete and carefully worked-out direct campaign for these special classes of business, who also receive the bulletin.

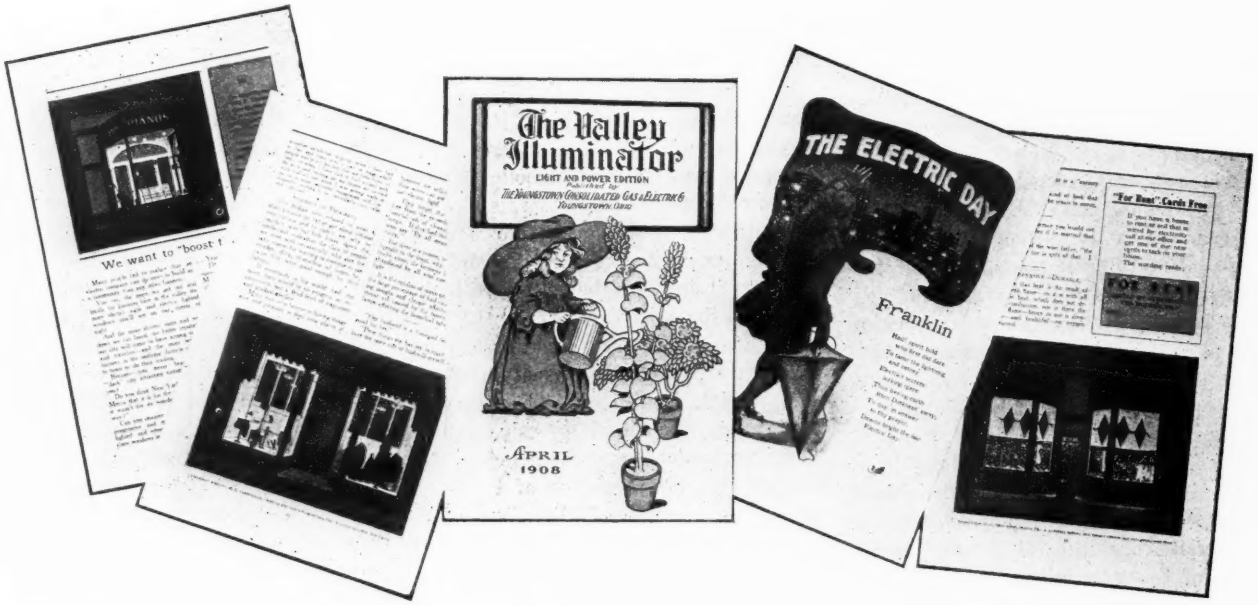
One excellent feature in one of the recent issues of the bulletin is the offer to supply free "For Rent" cards, the wording on which is as follows: "If you have a house to rent or sell that is wired for electricity, call at our office and get one of our new cards to tack on your house." On the card is the wording: "For Rent, lighted by electricity, the modern way. Apply ———." Here space is left for the insertion of the owner's name and address.

Reinforcing the advertising, excellent soliciting work is being done, and it is proposed to still further increase the effectiveness of this work as time goes on.

The solicitors and new-business department hold regular meetings to discuss ways and means of getting more business, thus carrying into practical effect the well-known truth that "two heads are better than one." At these meetings sales are demonstrated by the various solicitors, one man taking the part of the prospective purchaser, and others meeting his objections with selling arguments, etc.

A very energetic campaign is being made at the present time to increase the installation and revenue from sign business, with excellent results. Youngstown is fast becoming known as a particularly strong sign town.

A recent campaign of newspaper advertising which was conducted in the Sharon newspapers was effective in warding off threatened competition, and the reproduction of two or three of the talks of this series, which were especially prepared and published in the papers over the signature of the general manager of the company, R. Montgomery, will be of un-



Showing several pages of the April issue of "The Valley Illuminator," the monthly bulletin issued conjointly by the Youngstown, New Castle and Sharon companies.

doubted interest to other managers who may be confronted with similar problems. This series of talks, of which we can reproduce only a few, told in a very simple, understandable and concise way some of the reasons why the public had been kept ignorant of many facts about electricity which electric light companies would like to have told them. It was pointed out, in the very first advertisement, how exceedingly sudden the growth of the electrical industry had been, and how the men engaged in it had had no time to keep the public informed as it should have been. Subsequent talks gave very clear ideas as to how electricity was generated, how it had to be made as

Envelope enclosures sent out with monthly bills.

called for, and how sufficient generating capacity had to be maintained all the year around, in order to supply the peak load at the holiday season, and at other periods of increased demand.

SHENANGO VALLEY ELECTRIC LIGHT COMPANY,
63 West State Street, Sharon, Pa.

ELECTRIC LETTER NO. 1.

About twenty-five years ago half Cleveland turned out to see the very first arc light and many of the people brought with them pieces of smoked glass to look through so that their eyesight wouldn't be injured.

Only twenty-five years ago, mind you!

Do you realize what that means?

Well!—it means that all we know about electricity for commercial and domestic lighting and power has been learned and applied during one short quarter of a century.

And THAT means that the men who have been engaged in the electric lighting business have had to hustle to keep up with the constant changes and new discoveries and betterments which have crowded, one upon the other, during the twenty-five years.

And THAT means that YOU—the public—have not been made acquainted, as you should have been, with the facts about electricity and the difficulties attending its manufacture and sale.

And THAT, again, means THAT YOU—being left "in the dark" as to these facts and difficulties—have jumped to some very wrong conclusions in regard to these matters—conclusions unfair to the men who have engaged in the electric lighting business and who have been honestly trying (in spite of what you may think to the contrary) to serve you well and to give you a "square deal."

We are frank to admit that we are somewhat to blame for not having kept you better informed, but—the fact is—WE SIMPLY HAVEN'T HAD THE TIME.

As we have said—it has kept us hustling to keep up with the march of electrical progress; we have had to concentrate all our energies on that.

BUT—we're going to try to make up for this unintentional neglect and tell you some of these things we ought to have told you long ago.

To-morrow another of these letters will appear in this space—will you extend us the courtesy of reading it carefully?

E. MONTGOMERY, General Manager.

SHENANGO VALLEY ELECTRIC LIGHT COMPANY,
63 West State Street, Sharon, Pa.

ELECTRIC LETTER NO. 3.

Did you ever hear of the city girl visiting in the country who said—when she saw a plate of honey on the table—"Ah! I see you keep a bee!"

Now, that's just about as much idea as a great many otherwise well-informed people have as to how electricity is made.

They know we have a plant somewhere and they suppose we grind out a lot of electricity and run it into a tank and then whenever somebody in Sharon, South Sharon or Sharpsville wants some light we merely turn a switch and let a little electricity trickle out of the tank—just like so much water or molasses.

Now—if this were only so—about ninety-nine per cent of the electric light man's troubles would disappear forever.

But it isn't—more's the pity!

The fact is that electricity is one of those subtle, elusive things that you have to make AT THE VERY MOMENT IT IS WANTED—otherwise it's no good.

So—when people talk in that glib way about being able to make or sell electric current for scarcely anything per kilowatt-hour they are grossly misinformed, and are fooling themselves badly if they really believe this to be so.

Because—the only way in which such a statement could be true at all, would be if every one on the system burned every light he had twenty-four hours a day.

And who'd want to do that?

And where'd the economy be?

You might better pay twelve cents a kilowatt-hour for as many lights as you DO want to use at the time you want to use them than to contract to pay some absurdly inadequate sum per kilowatt-hour on the condition that you must burn ALL YOUR LIGHTS ALL THE TIME.

This space in the next issue of this paper will be devoted to a little straight talk, a subject which we are very anxious to have every one know about—we ask you to give these statements your consideration.

R. MONTGOMERY, General Manager.

SHENANGO VALLEY ELECTRIC LIGHT COMPANY,
63 West State Street, Sharon, Pa.

ELECTRIC LETTER NO. 4.

If you want to hire a horse and buggy on a fine Sunday afternoon, it's going to cost you more than at any other time in the week for the same service.

And—you know why—it's because that is just when every one WANTS TO RIDE.

Well!—one of the most frequent causes for otherwise reasonable people having acquired this habit of criticizing the lighting company is because we have felt it to be compulsory to ask more for current sold to certain classes of customers than we do from others, because the customers will, we know, call on our facilities JUST AT THE TIME WHEN EVERYBODY WANTS TO USE LIGHT.

We call this out "peak"—and, business which has a tendency to bunch itself close around our "peak" is, naturally, not as desirable from our point of view as business that is more likely to spread itself evenly over a much longer period of the day and night.

Do you see the point?

If we had the electricity in tanks or done up in parcels it wouldn't make any difference.

But—we have to make it AS IT'S CALLED FOR and that means that we've got to have ENOUGH men, ENOUGH engines, ENOUGH boilers, ENOUGH transformers, ENOUGH coal, ENOUGH of everything, in fact, to make ENOUGH electricity for the largest possible call that may be made on us at any time of the year even if that call only lasted for a few hours.

It scarcely ever happens—perhaps never—that every lamp and motor and current-consuming device in Sharon, South Sharon and Sharpsville is turned on at the same time—but it MIGHT happen—and we've got to be "there with the goods" in case it did.

Now—we're not looking for any sympathy

—just explaining a few things that we should have told you long ago.

Hope you're reading these statements. Another one to-morrow.

R. MONTGOMERY, General Manager.

Toward the end of the series of talks the new two-rate system, based on the Wright principle, was explained in a simple, matter-of-fact way, and the series ended with one or two talks tending to show that the Mahoning and Shenango Railway and Light Company is in business to serve the community faithfully.

SHENANGO VALLEY ELECTRIC LIGHT COMPANY,
63 West State Street, Sharon, Pa.

ELECTRIC LETTER NO. 7.

"What is this two-rate system the electric light company is making for lighting?"

There are two rates, twelve cents per unit and five and one-half cents per unit (a unit is 1,000 watts or one kilowatt-hour).

Now—here's the idea—after having burned your lights for an average one hour and twenty minutes each day at the twelve-cent rate YOU WILL ONLY HAVE TO PAY five and one-half cents per unit for all further current you use during the month.

Read that over again!

Read it ALOUD!

Under this system you, of course, pay only for the actual current used as shown by the meter.

Now—we claim this rate to be fair to all.

It represents THE RESULT OF THE BEST THOUGHT OF THE BEST MINDS in the electrical business.

Do you think YOU, or any one NOT IN THE ELECTRICAL BUSINESS, could make a fairer rate?

"Why is it fair?"

Because it permits every customer, large and small, to enjoy the low rate after he has burned his lamps forty hours each month.

EVERY CUSTOMER, MIND YOU.

We have already been very much pleased in the way in which our customers in Sharon, South Sharon and Sharpesville have taken to this plan, and we believe this very frank statement we have made will convince you of our sincerity and earnest desire to give you a "square deal."

Thursday we will try and make plain to you another cause, which, in our opinion, has contributed to your inclination to criticize some of our methods. Will you kindly read it carefully?

R. MONTGOMERY, General Manager.

SHENANGO VALLEY ELECTRIC LIGHT COMPANY,
63 West State Street, Sharon, Pa.

ELECTRIC LETTER NO. 12.

What are you doing to help boost Chicago?

"Well—that's a funny question to start off with," says some one.

"Why should Sharon, South Sharon and Sharpsville people help to boost Chicago?"

Let's tell you a little story: A lady who had the bad habit of buying goods by mail from Chicago called on a local merchant and asked him to subscribe toward some charitable cause.

He said he would gladly do so, provided he might place two other names after his own in the subscription book.

The lady was quite willing—so he wrote his own name for $5 and then put down:

Montgomery, Ward & Co., Chicago....$00.00
Sears, Roebuck & Co., Chicago..... 00.00

You see the point?

Now—we are "OF THE VALLEY AND FOR THE VALLEY" and everything we can do to influence you to keep your trade at home with our own merchants we ARE GOING TO DO.

Nothing surprising in it—either.

It's no more than right.

These same merchants are using our electric light in their stores and signs and windows—they are helping to make your streets brighter and cheerier and safer after nightfall.

They deserve the best support of all of us.

Our ambition—as a company—is to see Sharon a really, truly "electric city" and we're going to do all in our power to make it so.

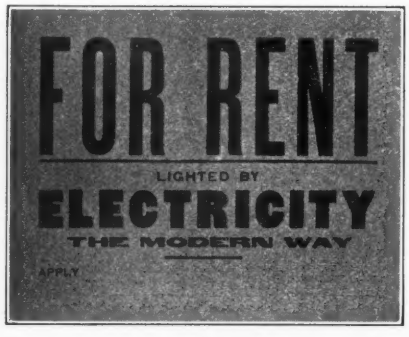
Let's ALL "boost for Sharon"—the electric city—let's ALL spend our money in Sharon and not go chasing off to Pittsburg and Cleveland to buy goods every chance we get.

Don't let's just TALK about "loyalty"—let's be loyal—and we ask you to feel that WE are "one of you" and that we want to get along with you just like one of the family.

R. MONTGOMERY, General Manager.

While there was nothing, as we have said, extraordinary about these talks from a literary or "college-professor" point of view, still, they possessed the merit of being, as we have said, understandable by the common people, and that, after all, is an exceedingly important thing to remember in our advertising.

That the entire central station fraternity holds a broader view of advertising than it did a year ago is a proposition which can not be denied successfully. When this sweeping movement for the modernizing of the merchandizing of electricity was inaugurated, three years ago, it was to be expected that, before a really high standard of appreciation of advertising means and purposes was attained, there would be many narrow and prejudiced views acquired by the fraternity.



"For Rent" card supplied to home-owners, real estate agents, etc., free of charge by the Mahoning & Shenango Railway and Light Company.

You will notice, if you look back over the past three or four years, many illustrations of wrong conclusions being arrived at because of success in one individual case or failure in another individual case. Men were looking at things with too microscopic an eye.

To-day the tone has been raised. Central station men have a better understanding of the broad scope of advertising, and, furthermore, realize that advertising has its proper place and sphere, and, far from being "the whole ball of wax," is but one of the important cogs in the machinery of a well-conducted commercial department for a lighting company.

ANNUAL CONVENTION OF THE NEBRASKA ELECTRICAL ASSOCIATION.

OMAHA, NEB., MAY 6 AND 7.

The Nebraska Electrical Association, which held its state convention at the Auditorium, Omaha, Wednesday and Thursday, May 6 and 7, in conjunction with the First Electrical Show of Omaha, went on record as favoring state inspection of wiring systems and the admission to its membership of managers of municipal electric plants. This latter proposition is one that has been long debated in the association, and there was still some opposition at the last, though not sufficient to defeat the proposition. The convention, which was remarkable in many ways, adjourned Thursday evening after the election of these officers:

President, E. A. Bullock, Norfolk, Neb.

Vice-President, S. J. Duncan, Kearney, Neb.

Secretary, William Bradford, Lincoln, Neb.

Treasurer, L. J. Schwingel, Holdrege, Neb.

Executive Committee—T. H. Fritts, Grand Island; B. P. Egan, Nebraska City; J. M. Roberts, York, Neb.

Selecting the place for holding the next annual convention was left to the executive committee, and the convention signified its preference of Omaha.

The convention was the largest attended in the history of the organization. The unusual interest was quickened, partially at least, by the fact that the First Electrical Show of Omaha was in progress all week at the Auditorium, a building splendidly equipped and adapted for the show, whose natural seating capacity is 6,500.

Retiring President T. H. Fritts in his annual address started the ball of action to rolling when on the first day of the convention he came out boldly advocating organized opposition to municipal ownership and state or general inspection of electrical plants and wiring. He asked that a standing committee be appointed to aid members who may have the municipal-ownership agitation to combat, and his recommendation received favorable consideration. On the subject of municipal plants President Fritts said:

"The belief seems to be popular that municipalities can manage electric lighting plants better than can private corporations. This we know is not true. But under the system of accounting in most of our cities it is at times many years before they learn the true condition of affairs and realize that their cost

of operation and maintenance is not clearly brought out to them. It is not unusual for the municipal lighting plant to be connected with and operated in conjunction with the water-works system, and in the segregation of charges against the plants too frequently the lighting plant is relieved of its true proportion of expenditures and made to show an earning which in reality does not exist. With the item of cost of plant and depreciation, loss of taxes also should be considered in estimating the cost of production, and not until we have strict accounting by the cities can we hope to combat the dangers always before us of the cities owning the plants."

On the matter of inspection he said:

"We are soon to be confronted with the proposition of wiring inspection. It is only too true that fires of unknown origin oftentimes are charged to improper wiring. This should not be, and the insurance interests of the country have awakened to the fact and are very much alive to the necessity for more rigid inspection. We must take notice and submit to inspections, both for the interests of the public and ourselves. I believe state or general inspection, with the expense divided between the insurance companies and the public, would be better than local inspection."

The sentiments expressed by President Fritts met with the most emphatic approval and were echoed in addresses that followed. E. A. Bullock, of Norfolk, the newly elected president, gave assurance that the policies of the Fritts administration would be continued in his administration. Mr. Bullock, in making his address, which was characterized by some strong utterances, faced W. S. Boyd, one of the chief representatives of the Nebraska Fire Underwriters' Association, who was seated across the table, and said:

"Fire insurance companies are making a big noise about the hazard of electrical wiring, but they are not doing anything to reduce the moral hazard, when there is more danger from overloading policyholders with insurance than there is from electricity. Insurance agents actually persuade men to carry more insurance than they should carry, and then when there is a fire the adjusters come along and pay the losses without investigation to find whether the fire was incendiary or not rather than lose the business.

"I have lived in Norfolk for years. There have been a great many fires in that city in my time, but I want to tell you that I can count the honest fires on the fingers of my hands.

"Insurance companies tell inspectors they have no backbone and blame the central electric lighting companies for the fires. They tell the managers they have no backbone—but, speaking of backbone, I want to say the insurance companies are the ones without it. They pay losses on incendiary fires every day, until there is a greater danger of a man setting his own building on fire with a match and jug of gasolene than there is in the electric wires starting the fires. The insurance companies are doing nothing to reduce or prevent the moral hazard."

In reply to Mr. Bullock, Mr. Boyd asserted that the state needed a fire marshal who would investigate the origin of fires and employ police powers to reduce the moral hazard.

This committee was then appointed to take action on the matter of inspection and report at the next convention: T. H. Fritts, E. J. Sullivan, of Omaha; E. V. Capps, of Blair.

Wednesday night the delegates assembled at the Henshaw Hotel, where an elaborate banquet was held.

OMAHA ELECTRICAL SHOW.

INAUGURAL EXHIBITION MEETS WITH GREAT SUCCESS.

The first annual electrical show to be held in Omaha, Neb., opened promptly at seven o'clock on the evening of Monday, May 4, in the Auditorium. Notwithstanding a downpour of rain, the great hall was crowded, and apparently nothing could interfere with the enthusiasm of the visitors and the loyalty to the Omaha enterprises. The hall was beautifully decorated with ropes and festoons of multi-colored incandescent lamps, and the exhibitors vied with one another in rendering their booths especially attractive.

The Electrical Cottage, which was the main display of the Omaha Electric Light and Power Company, showed a very complete furnishing, and included a reception hall, parlor, dining room, kitchen, bathroom, pantry, bedroom and library. The Nebraska Electric Company made a fine display of electrical devices, including washing machines, meat choppers, coffee grinders, sewing machines and other domestic devices. The Omaha Electrical Works showed a great variety of motors and dynamos, and repair apparatus. The Standard Electrical Company also made a fine display. The Westinghouse Electric and Manufacturing Company exhibited miscellaneous devices, including engines, generators, motors and air-brakes. The Automatic Lighting Company, of Chicago, Ill., showed a line of its specialties, and the Western Electrical Company showed a full line of electrical specialties. The Gamewell Fire-Alarm and Police Telegraph Company made a very extensive exhibit. The Crane Company, Chicago, Ill., made an exhibit of power-house steam apparatus, and the Lovett Electric Company made an exhibit of electrical machinery and house-cleaning apparatus. The Wolfe Electric Company, of Omaha, exhibited motors, electric irons, storage batteries, carriage lamps, motor-driven washers, wringers, fans and other electrical specialties.

One of the very interesting exhibits was that of the Nebraska Telephone Company, showing a great variety of telephone sets. The exhibit of the first telephone directory ever issued in Omaha, July 10, 1879, when there were but 104 subscribers to the system in Omaha, attracted a great deal of attention. The exchange which is to be used in the new Hotel Loyal, a handsome piece of mahogany, was exhibited. The Independent Telephone Company, of Omaha, also made a very attractive exhibit of its automatic telephone apparatus.

Among the other exhibitors were the following: General Electric Company, Crouse-Hinds Company, Central Telephone and Electric Company Fort Wayne Electric Works, Adams-Bagnall Electric Company, Benjamin Electric Manufacturing Company, Buckeye Electric Company, Economical Electric Lamp Company, Independent Arm and Pin Company, Nungesser Electric Battery Company, Blake Signal and Manufacturing Company, the Batteries Supply Company, Crescent Insulated Wire and Cable Company, the Duplex Metals Company, Federal Electric Company, Mathias Klein & Sons, National Carbon Company, Sprague Electric Company, Handel & Company, Ceramite Manufacturing Company, John A. Roebling's Sons Company, H. W. Johns-Manville Company, Nernst Lamp Company, I. L. Ide Engine Company and the Moline Incandescent Lamp Company.

During the week an excellent vaudeville programme was rendered in the theatre of the Auditorium.

On Thursday evening, May 7, a rejuvenation of the Sons of Jove was held at the Elks clubrooms. The rejuvenation was presided over by George W. Johnson, president of the Western Electrical Company, of Omaha, Jovian statesman for Nebraska. He was assisted by James A. Campbell, of the National Metal Molding Company, Pittsburg, Pa., and Edward D. Strickland, of the Robertson Electric Company, Buffalo, N. Y.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

A New Wireman's Tool.

The accompanying illustrations show an ingenious device which has been placed on the market by the Marshall Electric Manufacturing Company, 301 Congress street, Boston, Mass. This device combines in one tool several implements which the wireman finds necessary in carrying out his work. Where the wireman has to do with wires, flexible cord, cable, etc., a small side-cutting plier, a knife for cutting off insulation, a pair of round-nose pliers, and sometimes an angular-bladed trimming plier have been necessary.

The device illustrated herewith not only combines the several tools in one, but it renders the workman more efficient and makes it possible to do the job with less injury to the material involved. For instance, in stripping an insulating flexible cord with a knife, quite frequently a considerable number of the strands are cut, to say nothing of the frequency with which the workman himself is injured. This operation is accomplished by the Marshall wireman's tool instantly with no cutting of the strands and without the possibility of cutting the fingers. After the wire is stripped the end can be looped up into a perfect eye to fit a given size of screw with certainty and in a small fraction of the time usually consumed, and without any danger of scoring the wire.

The other operation of taking out a section of the insulation, where rosettes are attached or a branch is made, is also accomplished in a small fraction of the time heretofore used and without danger of damaging the wire.

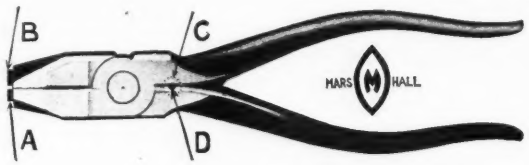


FIG. 1.—COMBINATION WIREMAN'S TOOL.

The wire-stripper consists of a guide hole extending nearly through the handles, C, in Fig. 1. This hole ends in a thin cutter with a small wire clearance hole in the centre D, with rounded edges.

The looping or eye-making device consists of two rounded studs, A and B (Fig. 1), on the ends of the jaws. One is adapted to loop for No. 6 screw, and the other for No. 8. The tool is used for Nos. 12 and 14 rubber-covered wire, No. 16 and No. 18 flexible cord, and No. 6 and No. 8 screws. The wire to be stripped is placed carefully in the guide hole C, and the cutters are closed and slightly turned at the point to be stripped. If the end is to be stripped, the plier is held at right angles, with one finger each side of the wire end. The pull is then lengthwise off the end of the wire, as shown in Fig. 2.

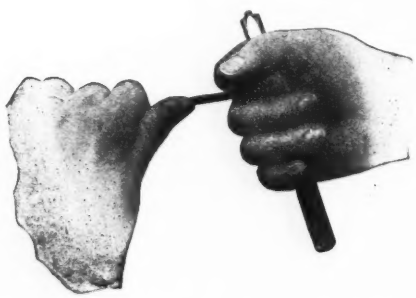


FIG 2.—STRIPPING THE END OF THE WIRE.

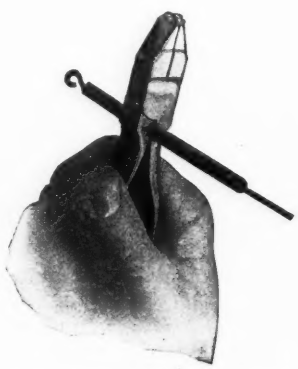


FIG. 3.—MAKING A CUT FOR STRIPPING A SECTION.

If a section is to be stripped the strip cutter is closed at one end of the section to be removed and the plier slightly rotated. The cutters are then turned the other way, making a cut just the width of the plier jaw. This is shown in Fig. 3. The end of the jaw of the pliers is then brought as nearly as possible on the diameter of the insulation, closed tight, bursting the braid, which is then twisted and torn off. This operation is shown in Fig. 4. If any of the insulation remains it will be found to be loose and can be removed with the fingers. A little practice will enable one to take the insulation all off clean at one motion. If a longer section than the width of the plier is to be removed, the operation may be repeated.

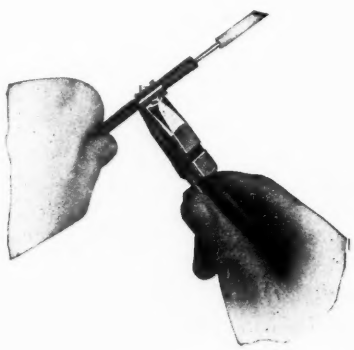


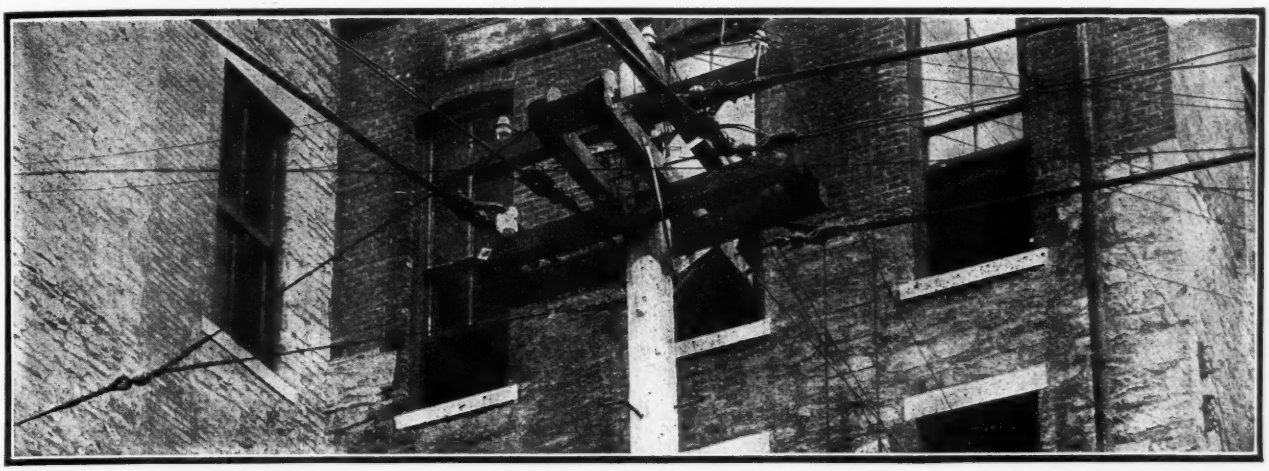
FIG. 4.—STRIPPING A SECTION WITH THE ENDS OF THE PLIER.

To loop the end of the barbed wire, the wire is caught tight between the studs on the plier nose, as shown in Fig. 5. The plier is then turned to roll the wire around the stud of the desired screw size. One motion makes a complete and perfect eye. A backward motion with the jaws released will straighten the eye to make it central with the wire.

FIG. 5.—TURNING AN EYE ON THE END OF THE WIRE.

The "Kearney" Cable Clamp.

One of the most successful devices used in modern line construction is the "Kearney" cable clamp, illustrations of which



GETTING OUT OF A TIGHT SQUEEZE IN AN ALLEY BY USING "KEARNEY" CABLE CLAMPS. POLE OWNED BY THE TOPEKA EDISON COMPANY, TOPEKA, KAN.

are shown herewith. The "Kearney" clamp is designed to supplant extra joints and fastenings necessary in the ordinary methods of cable suspension at angles, dead ends, etc. Three wrought-steel plates with four clamping bolts and one insulator holding bolt constitute the device. The two lower parts of the clamp are designed to fit the bare surface of the cable, and when the nuts on the four bolts joining the two parts are tightened, the clamp grips the bare cables so that the strain is transmitted through the upper plates to the strain insulator and guy wire. By the use of two of these clamps, holding the cable in both directions from an angle, the curved portion of the cable between the two clamps may be made short and relieved of all strain. This eliminates, of course, the necessity for making extensive and cumbersome splices, with their consequent waste of cable and electrical line losses.

A comparison of the costs of making a right-angle corner with 600,000-circular-mil cable by the cut-and-splice method and the "Kearney" method should prove interesting. The figures given are for an average case, and can, no doubt, be checked up with costs for similar work.

Cost of making old-style splice, corner turn—Cost of waste cable in splice and "make-up" (about fourteen feet), at fifteen cents per pound, $5.10; cost of labor, $2.50; broken saw blades, 10 cents; solder, 40 cents; tape, .55 cents; gasolene, 10 cents; cost of making up into strain insulators, $1.50; total, $10.25.

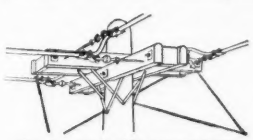


Fig. 1.—An inside corner turn with "Kearney" Cable Clamps, using "Bridle Guys."

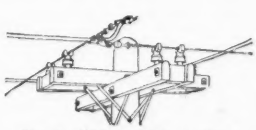


Fig. 2.—Same as Fig. 1, using Straight Guys.

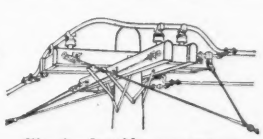


Fig. 3.—Outside corner turn, using "Kearney" Clamps and the "Bridle Guy Method."

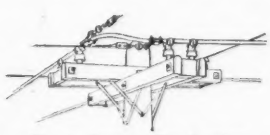


Fig. 4.—Same as Fig. 3, using Straight Guy Method.

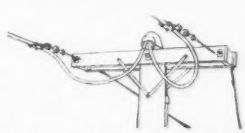


Fig. 5.—Dead-ending Two Cables at O. G. Junction Pole by Means of two "Kearney" Clamps.

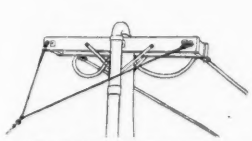


Fig. 6.—Showing reverse of Fig. 5.

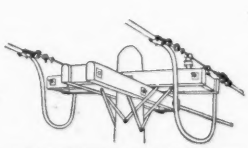


Fig. 7.—Showing method of leaving slack in line for future use by means of "Kearney" Clamps.

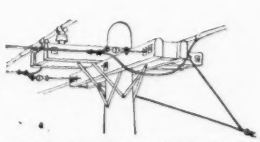


Fig. 8.—Showing method of relieving strain caused by right-angle taps by means of "Kearney" Clamps.

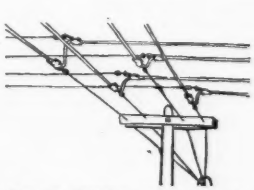


Fig. 9.—Making a right-angle corner turn where it is not possible or practical to locate pole on corner of street.

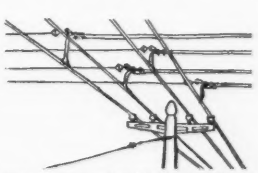


Fig. 10.—Showing Method of Making Mid-Span Taps in a Feeder Line by Means of "Kearney" Cable Clamps.

Cost of making corner turn with "Kearney" cable clamps—Cost of cable clamps (maximum), $3; cost of labor, 50 cents; cost of tape, 20 cents; actual cost with clamps, $3.70.

These clamps are made by W. N. Matthews & Brother, 219 North Second street, St. Louis, Mo.

The Westinghouse Machine Company's Exports.

It is gratifying to note the continued demand from the Far East for American machinery manufactured at East Pittsburg.

Japanese industries are particularly active in this direction and within a recent period the Westinghouse Machine Company has booked a large number of orders through its Japanese representatives, Messrs. Takata & Company, of New York and Tokio.

Three 500-kilowatt Westinghouse turbines have been shipped to the Imperial Steel Works, Japan, and to the Hakkaido Tanko Steamship Company. The Noble School, Japan, has installed a gas-engine producer plant. Four 105-horse-power compound engines go to the Tamagawa Electric Company, Japan, and to a private isolated plant in China. Other equipments have been ordered by the Acadia Sugar Refining Company and the Yamada Hospital.

New Pull-String Turn-Down Lamp.

The Economical Electric Lamp Company, 96 Warren street, New York city, has placed on the market a new pull-string turn-down lamp. This lamp is a great convenience, is economical of current and will fit into every application where such convenience and desirability are feasible. The lamp is equipped with

New Pull-String Turn-Down Lamp.

two filaments, and when turned on full gives sixteen candle-power. When turned down the smaller filament gives one candle-power, and the pull-string operates throughout the entire range, giving full candle-power, one candle-power, and turning out the lamp.

New Power Equipment for the East Youngstown Mill of Youngstown Sheet and Tube Company.

The Youngstown Sheet and Tube Company, of Youngstown, Ohio, has lately placed a contract with the Allis-Chalmers Company, of Milwaukee, Wis., for three large motor-generator sets intended for operation in connection with two 1,500-kilowatt Allis-Chalmers steam turbines and generators ordered some time ago.

The equipment will also include two induction-motor exciter sets, a balancer and transformers of the oil-filled, self-cooled type. The main motor-generator sets each comprise 500-kilowatt, 250-volt, direct-current generators and 750-horse-power, 6,000-volt, twenty-five-cycle motors. This addition will give the plant electric current for lights, crane operation, furnace skip, etc. The added power, to provide which practically a new power-house was required, was rendered necessary by the erection of two new blast furnaces.

One of the turbines is designed to operate condensing and one non-condensing, with steam pressure of 150 pounds per square inch. The exhaust from the non-condensing turbine is to be utilized for heating boiler feed-water in an open-type heater. Julian Kennedy, of Pittsburg, Pa., acted as consulting engineer.

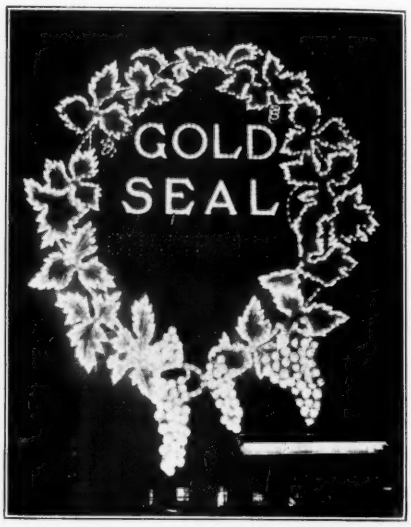
Some Notable Electric Signs.

The accompanying illustrations show a number of very handsome signs which have recently been installed by the Thomas Cusack Company, outdoor advertising experts, 500-510 Throop street, Chicago, Ill.

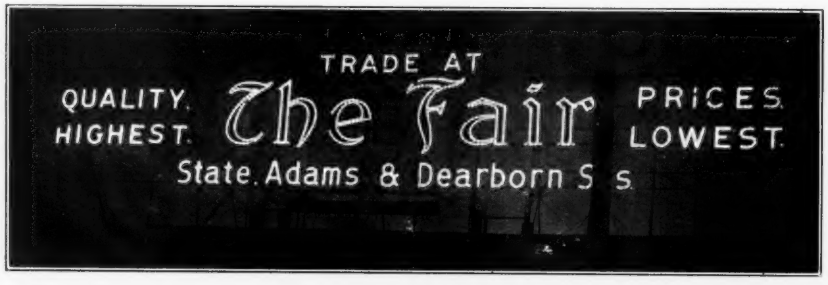
The "Gold Seal" sign is fifty-five feet high by forty-two feet wide. There are 1,572 lamps in the entire sign. The letters in the words "Gold Seal" are four feet high, and in the word "champagne" two and one-half feet high. Nine and one-half tons of structural steel and 7,500 feet of wire were used in the construction of this sign, and it was lighted within fifteen days after work was begun.

"The Fair" sign facing east has 1,450 lamps, and is 120 feet long by thirty-three feet high. The small letters in this sign are three feet high; the initial letters, "T," "h" and "F" are twelve feet, six inches high, and "e" and "air" are nine feet high. Eight tons of structural steel were used in this sign, and it was lighted within twelve days from the time work was commenced. "The Fair" sign facing south is eighty feet long by forty feet high, and has 1,599 lamps. There were eleven tons of structural steel used in its construction, and it was lighted thirteen days after construction was started. The streak of lightning running from the top of the sign down into the centre is 150 feet long, and is operated by a four-foot flasher with four combination switches. The streak of lightning first strikes down in the centre of the sign and lights up the red centres of the words "The Fair." These words contain about 370 lamps on a red background. They are lighted for about two and one-half to three seconds, when the second combination switch on the flasher closes, and at the same instant the switch operating the red lamps goes off. The second switch lights 620 white lamps in the same letters, giving the effect of changing the sign from red to white. The white lamps are lighted from two and one-half to three seconds, when the third and fourth switches on the combination flasher close, making the sign read "Trade at The Fair, State, Adams and Dearborn Streets," all in white. This completes the operation of the sign, and it goes out and repeats.

The "Toasted Corn Flake" sign has 1,087 lamps, is sixty-two feet long by



1,572 Lamps; Fifty-Five Feet High; Forty-Two Feet Wide.



1,599 Lamps; Eighty-Two Feet Long; Forty Feet High.

1,240 Lamps; Forty-Five Feet High; Thirty-Two Feet Wide.

forty-five feet high, and from the top of the sign to the sidewalk measures 150 feet. The sign was lighted in fourteen days from beginning construction. The flasher

1,087 Lamps; Sixty-Two Feet Long; Forty-Five Feet High.

used on this sign measures ten feet six inches over all, being the largest flasher of this kind ever made. The streak of light running from the top of the first story of the building up over the entire sign and down to the "W" in "W. H. Kellogg" contains 160 four-candle-power lamps, and is arranged on forty circuits. The script letters in "W. H. Kellogg" contain 372 two-candle-power lamps. The entire sign is steady-burning, with the exception of the signature, which is written out one letter at a time as soon as the streak of light gets around to it. The letters in the word "toasted" are five feet high. In "Corn Flakes" the capitals are six feet high and the balance of the letters five feet high. The words "look for this signature" contain three and four-foot letters. In the signature, the "W," the "K's," the "l's" and the "g's" are eight-foot letters straight up and down and about thirteen feet on the slant. The "e" and "o" are four feet high. Twelve tons of steel and 16,000 feet of wire were used in this sign.

The "White City" sign is forty-five feet high and about thirty-two feet wide. The fountain at the highest point is thirty-five feet, and the bowl is twenty-four feet across. There are 1,240 lamps used in the sign, 740 of which are in the fountain. To give the effect of water flowing continually from the bowl of the fountain, and spraying out, a flashing machine seven feet long, with 172 points, is employed. The letters in the words "White City" are six-foot and three-foot letters. In the words "open May 16" the letters are thirty inches high. In the words "southbound cars" the letters are twenty inches high. The sign was lighted twelve days after work on it was started, and it contains 8,000 feet of wire and six tons of iron.

The Whitney Opera House sign is twenty-two feet by thirty-two feet, and has 1,583 sockets. This sign is used with a flasher, and the only parts which stay lighted all the time are the border and

1,583 Lamps; Twenty-Two Feet Wide; Thirty-Two Feet High.

the figures of the boys at the foot of the sign. The balance of the sign goes on in a cycle, which starts with a flash of light at the flower-pot, running up a line of sockets in the middle of the sign to a point at the top, where it divides and runs to a higher point, where each beam bursts and throws out a shower of colored streamers. These stay lighted for a few moments and then go out, working from the top. As the last of these goes out the word "Whitney" lights, this being followed by the words "a howling success," which, in turn, are followed by the words "three twins," after which the entire sign goes out and the cycle is repeated.

The electrical portions of all of these signs were constructed by the Federal Electric Company, the work of installation being done by separate contractors. They have Federal copper shell clamp sockets throughout.

Municipal Lighting Plant of the City of Jacksonville, Fla.

Some years ago the city of Jacksonville, Fla., decided to put in a municipal lighting plant to furnish light for both municipal and private use, and a plant was built in 1895 at a cost of $76,676. At that time a corporation had a franchise for both lighting and traction purposes, and competed with the city. When this company applied for an extension of its charter the city granted it, with the stipulation that the company pay into the city treasury twenty per cent of its gross receipts from lighting and power service.

The lighting plant contains several Babcock & Wilcox boilers, two of 500 horse-power, four of 350 horse-power and one of 250 horse-power. The motive power was originally reciprocating engines belted to generators, but this has been changed gradually to direct-connected steam turbines. At present there is one 750-horse-power cross-compound engine, three 200-kilowatt DeLaval turbines, two 500-kilowatt Allis-Chalmers horizontal turbines and one 500-kilowatt Curtis turbine. The contract has been let for another 1,500-kilowatt Allis-Chalmers turbine and one 300-kilowatt motor-generator.

The plant and system have been continually extended and have cost about $490,000. The receipts in 1906 from commercial service was $184,798.24, and from the city $38,003.90; miscellaneous, $882.15. The expenditures for superintendence and office were $8,444.16; power station, $71,407.79; lines and service, $27,182.37; miscellaneous, $5,930.80. The net profit was $110,719.17, or more than twenty-six per cent of the cost. Of this, $60,128.48 was spent on extensions. In the last seven years the revenues have increased nearly eightfold and the operating expenses a little over fourfold.

A New Tungsten Diffusing Cluster.

To fill the demand for a large lighting unit of approximately the same power as the enclosed arc lamp, the General Electric Company, Schenectady, N. Y., has perfected the tungsten economy diffusing cluster.

The diffuser is designed primarily to carry six tungsten lamps suspended in a vertical position. Very good results, however, can be obtained by the use of either tantalum or carbon filament lamps. When the latter are used the platform carrying the lamps can be readily lowered without taking the fixtures apart. This adjustable feature makes the fixture universal for all types of incandescent lamps.

TWENTY-SIX-INCH TUNGSTEN "ECONOMY" DIFFUSER, CHAIN SUSPENSION.

The illustration shows the standard twenty-six-inch cluster. The diffuser is made of steel, coated with white porcelain enamel on the under side and black on the top. The supporting reflector is made of brass with a nickel finish and carries springs to compensate for expansion or variation in the size of the globes. The casing is finished in streaked oxidized copper.

The thirty-nine-inch or mill-type diffuser is identically the same as the twenty-six-inch, except that the diffuser is larger, and, instead of being finished in porcelain enamel, is coated with white zinc enamel. For store lighting, the twenty-six-inch diffuser is recommended and for mill and factory work the thirty-nine-inch gives more satisfactory results as regards distribution and diffusion.

It has been found from experience that the thirty-nine-inch tungsten economy diffusing cluster gives excellent results for mill lighting when equipped with three 100-watt tungsten lamps. This permits, for the same energy, somewhat closer spacing than arc lamps.

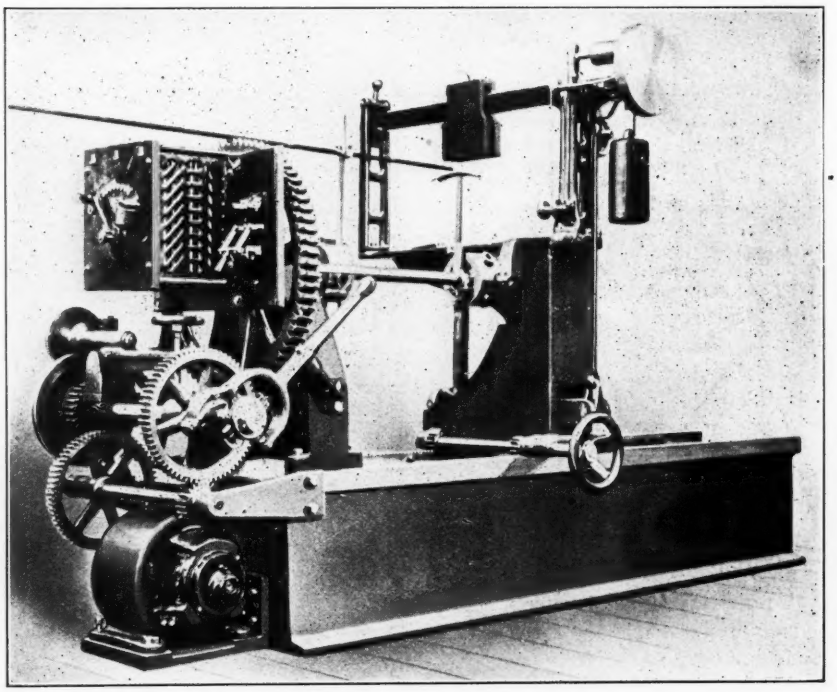
The shade is made of clear glass frosted on the inside, and as may be seen from the illustration is curved to take the same general shape as the lamps. Placing the frosting on the inside of the shade gives a lower intrinsic brilliancy than is obtained by the same grade of frosting placed on the lamps, and does not reduce the life of the lamps. The six-lobe shade is standard for all lamp combinations and the curvature of the shade minimizes the spotted effect so apparent when part of the lamps are extinguished in a fixture having a spherical globe.

By using various combinations of forty, sixty and 100-watt lamps, the cluster can be made to operate with 120, 180, 240, 300, 360, 420 and 480 watts.

Westinghouse Motors in Laboratory Service.

Electricity supplied to a motor that can be relied upon is the ideal power for driving the apparatus necessary for laboratory testing. The illustration shows a typical application of the Westinghouse type "R" direct-current motor to a machine of this description. It affords the most independent power for the purpose and does away with the line shafting and belts that are highly undesirable in a well-kept laboratory. Space is generally an important consideration in a laboratory, and it will be seen from the cut that the motor fits into the machine so as to require no more space than if it were not present.

The machine to which this motor is connected is an improved torsion testing machine for testing one-and-one-half-inch round or square specimens of any length up to five feet, designed and manufactured by Tinius Olson & Company, of Philadelphia.



MOTOR-DRIVEN TORSION-TESTING MACHINE.

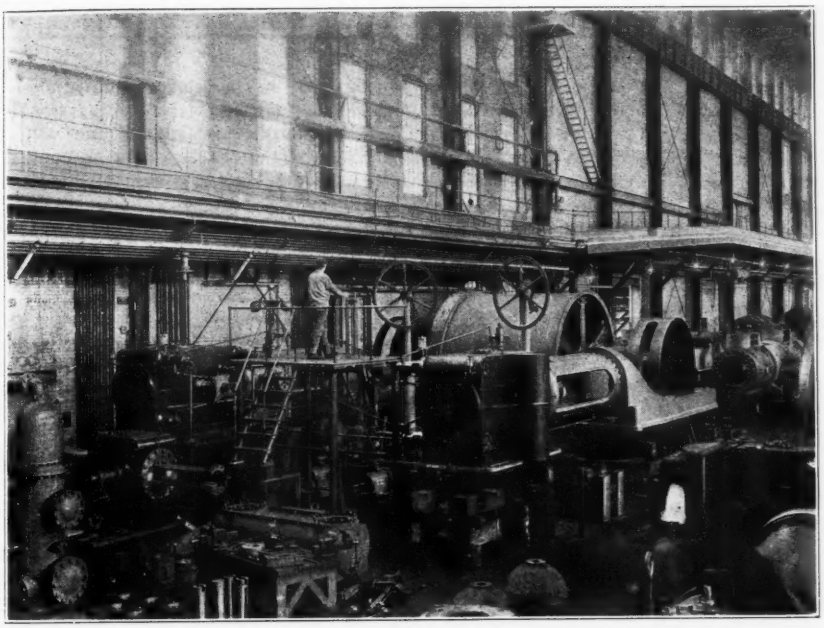
The Manufacture of Electric Flashers.

The Reynolds-Dull Flasher Company, 152 Fifth avenue, Chicago, Ill., announces that Judge Kohlstaat, in the United States Circuit Court, Northern District of Illinois, handed down an opinion on April 22 sustaining E. R. Dull's Sinclair patent, allowing an injunction and restraining the Reynolds Electric Flasher Manufacturing Company, of 191 Fifth avenue, Chicago, Ill., from further manufacturing and selling what have heretofore been known as the "Reynolds" and "Reco" flashers.

The latter company states that this decision was reached in consideration of the fact that its type of flasher had embodied certain parts protected by a patent granted in 1896, and that it is neither surprised nor handicapped at this decision of the court. It states that it has provided itself against this event, and has another flashing device which it has named the "New Reco." This flasher is now on the market.

A Record Production of Hoisting Engines.

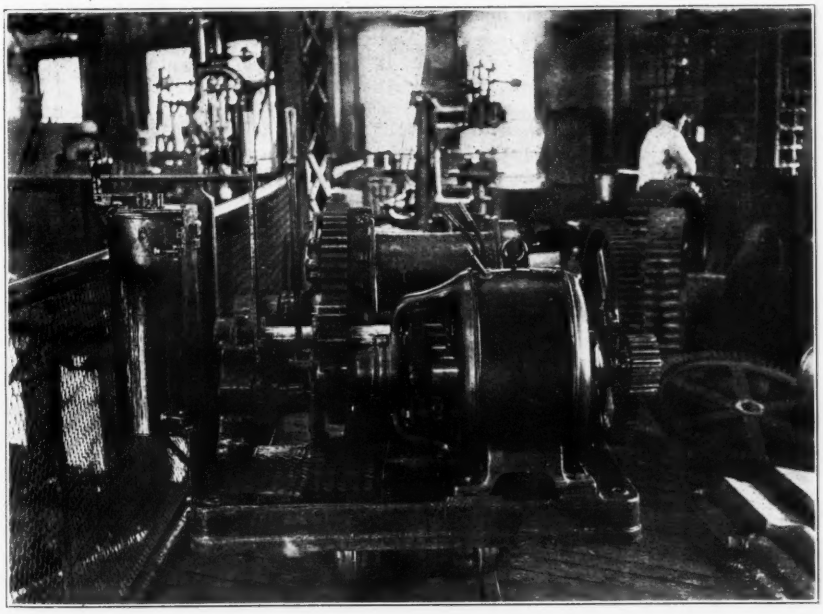
The mine hoist, whatever may be the method used to drive it, forms the all-important connecting link between the underground workings and the surface; and by reason of this position the efficiency of the mine demands the best possible hoisting facilities, without which the best properties are made expensive to work and unproductive.



ALLIS-CHALMERS THIRTY-FOUR-INCH BY SEVENTY-TWO-INCH DIRECT-ACTING, SINGLE-DRUM CORLISS HOISTING ENGINE, CONSTRUCTED FOR THE OLIVER IRON MINING COMPANY'S CHAPIN MINE.

Hoisting devices vary in type, size and motive power with the class and amount of work which will be required of them, the stage of development of the mine, local prejudice and endless other conditions too numerous to mention.

The smaller mining propositions, as a rule, present no serious difficulties in the way of selecting the proper type of hoist to be used. In large works, however, the question of motive power, method of balancing, economical use of steam in the steam-driven hoists, maximum loads, speed of hoisting, etc., all demand careful consideration.



ALLIS-CHALMERS TYPE "K" MOTOR GEARED TO FIFTEEN-HORSE-POWER, SINGLE-DRUM ELECTRIC HOIST.

The great variety of applications to which hoists have been put for all sorts of mining has naturally caused the development of a number of different forms of the hoisting engine, both steam and electric driven, each of which has its own uses for which it is peculiarly suited. The Allis-Chalmers Company, Milwaukee, whose long years of experience in building mining machinery have naturally thrown them in contact with a good many hoisting-engine applications, is especially prepared to furnish hoists of any kind, electric, slide valve or Corliss and for any service. Within recent times this company has built or is now building fifty-six hoisting-engine units in all, twenty-nine of which are of the Corliss type, seventeen electric hoists and ten of the other types. Thirty-three of these units have double drums and the others are constructed with single drum. The largest drum used was that on a double-drum hoist built for the Oliver Iron Mining Company, being twelve feet in diamter and ten feet in length. This unit is to be located at the Chapin Mine.

Following are the names of some Allis-Chalmers hoisting-engine operators, including recent purchasers: Boston & Montana Consolidated Copper and Silver Mining Company (two units); Alaska Treadwell Gold Mining Company; Quintera Mining Company; Oliver Iron Mining Company (six units); Atlantic Mining Company; H. Eckstein, South Africa (five units); Michigan Copper Mining Company; Oriental Consolidated Mining Company; Newfoundland Syndicate; Montana Coal and Coke Company; Consolidated Gold Fields of South Africa; Pocahontas Collieries; Robinson Deep (four units); Shattuck Arizona Copper Company; Madison Lead and Land Company; Backus & Johnson; Arminius Chemical Company; Angelo Deep Gold Mining Company; Rand Mines; Cleveland Cliffs Iron Mining Company; Milwaukee Coke and Gas Company (three units); Semet, Solvay Company, South Deering, Ind. (three units); Stevenson Iron Mining Company; New Jersey Zinc Company, and Lehigh Coal and Navigation Company.

Electrical Supplies for the Navy Department.

The Bureau of Supplies and Accounts will open bids in Washington, D. C., on June 9, for the following electrical material: Ten ammeters, 350 dry batteries, seventy-two platinum key contacts, 200 Leyden jars, thirty inches platinum, miscellaneous telephone fixtures, 100 feet of Wollaston wire, for delivery at Mare Island, Cal.

Current Electrical News

DOMESTIC AND EXPORT.

PROPOSED MEXICAN ELECTRIC LINE—Felix Martinez has authorized the announcement of his plan for the construction of an electric railway in El Valle. The time for commencing the work is not yet decided, owing to the nature of the lands through which the line will pass, but means of overcoming this difficulty are being considered.

ILLINOIS TUNNEL SYSTEM TO BE EXTENDED—Plans for the rapid extension of the automatic telephone system of the Illinois Tunnel Company, Chicago, Ill., have been completed and it is announced that 100,000 new instruments will be placed in service. The tunnel company has completed arrangements for the issuance of a first mortgage on the entire property, which will enable it to take up the underlying liens and provide ample funds for the amplification of the telephone plant.

NEW ELECTRIC LINE FOR ARKANSAS—The Little Rock & Hot Springs Electric Railway will, it is announced, let contracts shortly for building its proposed line from Little Rock to Hot Springs, Ark., fifty-six miles long. It plans to build its own power station. The capital of the company is $2,000,000. The officers are as follows: C. J. Kramer, president; L. Garrett, vice-president and general manager; J. C. Marshall, secretary; George W. Rogers, treasurer; J. F. Russ, superintendent; P. M. Pierce, electrical engineer.

PLANS BEING FORMULATED FOR WESTERN ROAD—Representatives of thirteen cities in the Arkansas Valley in both Colorado and Kansas met recently with a representative of the Northern Electrical Company, of Madison, Wis., to discuss plans for the industrial development of the valley by means of electricity. The company plans to build a large power-house near the coal fields of Cañon City, to build an interurban railway from Cañon City, Col., to Dodge City, Kan., and an electric power line to furnish power to all the cities in the valley. It is proposed to establish pumping plants along the Arkansas River and pump water by means of the long irrigating ditches at present in use. The development of the scheme will mean the outlay of $15,000,000. The plans were endorsed by the business men present.

NEW MEXICAN HYDROELECTRIC PLANTS—The Guanajuato Power and Electric Company, which is supplying electric current to the Guanajuato mining district and to several towns, is completing a second hydroelectric plant at El Sabino, state of Michoacan, Mexico, that will generate 6,000 horse-power. By the end of this year a third plant, utilizing waterfalls some distance from Sabino and having a capacity of 12,000 horse-power, will be finished. The company is now generating 10,000 horse-power at its Platinar plant near Zamora, Michoacan, and at the opening of 1909 will therefore have a total capacity of 28,000 horse-power. There is now a demand for practically all this power. The Guanajuato Power and Electric Company has about $3,000,000 gold invested at the present time. Colorado men are principally interested in the company. The average price secured for current is $150 Mexican currency per horse-power-year.

EXTENSIVE OHIO ELECTRIC SYSTEM—With the completion of the construction of the Lake Erie and Youngstown Railway from Youngstown to Conneaut, Ohio, direct traffic north and south between Lake Erie and the Ohio Valley will be available. This company, with its capital stock of $3,500,000, has seventy-five per cent of the right of way secured, and the financing of the proposition has already been completed. John H. Ruhlman, who is at the head of this company, was also interested in the construction of the Youngstown & Southern Electric Road, which is now completed between Youngstown and within two miles north of East Liverpool, Ohio. In forming this direct route between the Ohio River and the lakes both roads will be used, and the operation of limited electric cars between Conneaut and East Liverpool is a leading question with the corporations. The Youngstown-Conneaut line will be operated by gasolene-electric cars, while the Youngstown & Southern company will use the overhead trolley system, power being obtained from a power-house already completed at West Point. At East Liverpool there will be direct routes north of Pittsburg and Rochester, and the Beaver Valley, and southward to Steubenville, Wheeling and other points down the Ohio Valley.

WORK STARTED ON NEW TROLLEY LINE—The Brownsville, Masontown & Smithfield Street Railway Company has awarded a contract to the Pennsylvania Railroad Construction Company for the building of the division running from Brownsville to Masontown, Pa., and several hundred men are at work. The new system will connect Morgantown, W. Va., with Pittsburg, Pa. It traverses Fayette, Greene and Washington counties, is 120 miles long and will give rapid transit to twenty enterprising towns in the coal and coke belt. It is expected that the line will be completed within a year. The new company has an authorized capital stock of $2,500,000, of which $2,000,000 has already been subscribed, and is authorized to issue $3,000,000 first-mortgage thirty-year five per cent gold bonds. W. J. Shaldon, of McKeesport, is president of the company. The company will construct a standard-gauge electric railway through the towns of Masontown, West Masontown, East Millsboro, Gates, Lambert, Edeborn, Ronco, New Geneva, Point Marion, Smithfield, Republic, Martin, Riverview and Uniontown, and will run from some point on the main line by way of Carmichaels, Rices Landing, Jefferson and Waynesburg, in Greene County, and Zollersville, Clarksville, Bealsville and Bentleysville, in Washington County, connecting with the Charleroi line of the Pittsburg Railways Company for Pittsburg, covering 120 miles and linking Morgantown with Pittsburg. The power plant of the railway company will be located at West Masontown on the Monongahela River, one and a half miles west of Masontown, which is the central point, where coal is cheap and water available.

INTERURBANS FOR YAKIMA VALLEY, WASH.—The building of an interurban system which will connect the principal cities and towns in the Yakima Valley, Wash., is planned by the Yakima Valley Transportation Company. That the company will build seventy miles of electric railroad at an approximate cost of $2,000,000 has been announced by the men interested in the local company, who now have a three-mile road in operation over Nob Hill. Preliminary surveys have been made, rights of way have been secured, the capital has been subscribed and some of the material for this system is now on the road. Other material will be ordered as rapidly as extension can be made. A. J. Splawn, one of the pioneer ranchers of the Yakima Valley, is president of the company, and G. S. Rankin is vice-president and general manager. Murray B. Miles is secretary. The board of directors includes Alex. Miller, J. O. Cull, Dr. C. G. Fletcher, A. E. Larson and W. P. Sawyer. E. M. Kenly is chief engineer and superintendent. The first extension of the railroad will be to the Washington state fair grounds. This extension is to be finished in time for the state fair of 1908. From the fair grounds the road is to be continued south to Yakima City, then across the Yakima River and through Union Gap toward Parker and Zillah. Eventually this road will be built on to Granger and Sunnyside, tapping the finest fruit country of the valley. Another line is to be extended southeast of the city for about twelve miles, through the Moxee Valley. The present Nob Hill line is to be extended six miles to Ahtanum, and another line is projected over the north side of the Nob Hill district. Still other freight roads are eventually to be constructed through the same districts. The Fruitvale and Selah districts also are to have electric roads, built by the same company.

ELECTRIC LIGHTING.

CASCADE, COL.—Preliminary steps have been taken for the construction of an electric light plant.

EAST LAKE, ALA.—The Birmingham Railway, Light and Power Company has been awarded a contract for thirteen street arcs.

CLINTON, LA.—A committee of three has been appointed to investigate the matter of municipal ownership of the electric lighting facilities.

BOSTON, MASS.—The gas commission has authorized the Haverhill Electric Light Company to issue 1,145 additional shares of capital stock to be offered to stockholders at not less than $130 a share.

JACKSON, MICH.—The Commonwealth Power Company will erect a new dam at Plainwell, at an expense of $50,000, to take the place of the one washed out by flood. The work will occupy the entire summer.

SEWARD, NEB.—John Martz, manager of the Seward municipal electric light plant, has been chosen consulting engineer for the new electric light and water plant to be erected at Wahoo. The latter town recently voted $65,000 for this improvement.

THERMOPOLIS, WYO.—H. J. Thompson, of Billings, Mont., has purchased the Thermopolis electric light plant and franchise for $30,000. The system will be improved at once, and possibly a line of street railway built to connect the town with two hot springs.

LEHIGH, IOWA—Homer V. and J. M. Williams are at work on plans to give Lehigh an electric lighting plant. It is planned to utilize the power of the Des Moines River to generate the current. If present plans carry out a $10,000 plant will be erected during the summer.

ORION, ILL.—The contract for the rebuilding of the electric light plant which was burned down some weeks ago has been let to Victor Palmgren, of Orion, and work will start at once. The new building will be of brick with concrete floors. It will cost between $6,000 and $7,000.

MILFORD, N. J.—The Milford Light and Power Company has absorbed the Milford Electric Light Company. Extensive improvements will be made to the property on Souhegan street, including the installation of another engine of 500 horse-power, larger dynamos and additional pole lines.

TELLURIDE, COL.—At the annual election of the Beaver River Power Company, a Colorado corporation with a power plant near Milford, Utah, the old directors and officers were re-elected with L. L. Nunn as president. The company proposes, during the coming season, to erect another plant in the vicinity of Milford.

ST. LOUIS, MO.—The William A. Corrao Electric Company, which is installing a complete electric plant to furnish electric current for 140 buildings at Fort Sam Houston, San Antonio, Tex., has been awarded contracts by the War Department for plants at Fort Riley, Kan., and Fort D. A. Russell, Cheyenne, Wyo.

HIGH BRIDGE, N. J.—The High Bridge borough council has decided to call a special election to be held June 9, for the purpose of bonding the borough for $15,000 for the building of a municipal lighting plant. At a recent special meeting a resolution was passed by unanimous vote of the council for the erection of such a plant.

MONROE, WIS.—E. B. Bucher, owner of the water power at Martintown, has under consideration a plan to put in an electric plant and furnish current for lighting nearby towns, including Warren, Lena, McConnell and Winslow, as well as Martintown. It is stated at least 400 horse-power can be developed even at low water.

CORPUS CHRISTI, TEX.—A new electric light and power plant is soon to be installed in Corpus Christi under the management of E. D. Kelly, of Hillsboro. Mr. Kelly has already begun planning the installation of new wire in the business section of the city and the location has been purchased and machinery ordered. The company expects to have the plant in operation within six months.

BOISE, IDA.—A contract for 65,000 barrels of cement, which will cost approximately $260,000 and which will be used in the construction of the dam to be built in the Salmon River about thirty miles south of Twin Falls, has been let to C. R. Shaw by D. C. MacWatters, of Milner, the general manager of the Twin Falls Salmon River Land and Water Company, which has charge of the Salmon River project.

WENATCHEE, WASH.—A franchise has been granted to the Entiat Power Company by the city council containing the stipulation that the company shall put up the sum of $850 in cash to insure the delivery of electric power for heating and lighting into this city by November 1, 1909. It is expected that the power company will accept the franchise within the next thirty days, as it has already begun operations on a $100,000 plant at Entiat and has several contracts with local parties for power.

INDIANAPOLIS, IND.—Articles of incorporation have been filed at the office of the secretary of state for the Bedford Power Company. The capital stock is now designated as $50,000, but this, it is explained, will be increased soon to $400,000. Among the incorporators are: Harry S. New, H. A. Mansfield, John W. Holtzman and James B. Nelson. Several residents of Bedford are also interested. The new company plans to dam the east branch of White River, near Williams, Ind., in Lawrence County, and erect a power plant for the generation of electricity, which will be transmitted ten miles for use at the plant of the Bedford Cement Company and at the Bedford quarries.

STEUBENVILLE, OHIO—The board of service at Wellsville has been authorized by the council to enter into a contract with the Steubenville & East Liverpool Traction and Light Company to furnish electric lighting for the city for a period of five years from April 1, 1908. The price at which arc lights will be furnished is $72 per light per year, the city to use eighty or more lights. The company also agrees to furnish forty or more incandescent lights at a cost of $28 each per year. The contract with the lighting company expired on April 3, and lights have since been furnished by an agreement between the company and the committee appointed by council to investigate the lighting matter.

FITCHBURG, MASS.—Thirty grants of perpetual right of way have been recorded for the Connecticut River Power Company, which is seeking to enter Fitchburg with electric power for manufacturing purposes. The grants include right to erect and maintain a double line of poles and towers across land in Westminster, Leominster and Fitchburg, connecting at Westminster with lines direct to power stations near Brattleboro, Vt. The course followed by grants is by way of the "Narrows" in Westminster over the old turnpike in West Fitchburg, through a corner of Leominster and down into the Cleghorn district, a busy manufacturing section of the city.

WARREN, OHIO—The stockholders of the Hydro-Electric Company, a new $100,000 corporation, have completed organization by electing the following board of directors: O. D. Morgan, C. M. Wilkins, Henry Herbert, Roy Seigfried, D. E. Hoover. Mr. Morgan is to be the president of the company; C. M. Wilkins, vice-president, and Henry Herbert, secretary and treasurer. The company has secured an option on a strip of land on Dana avenue, where it expects to locate its power-house. Mr. Wilkins stated that the work of erecting its line of poles from Newton Falls to Warren, for the holding of power-carrying cables, would be started soon. It is the intention of the company to also furnish power and light to property owners along the route.

MARQUETTE, MICH.—The Escanaba Pulp and Electric Company's power plant at Flatrock, Delta County, will go into commission in July. Power is secured from the Escanaba River, which has been harnessed by the erection of a solid concrete dam, 500 feet long. The plant will develop 1,200 horse-power. Contracts have already been made to furnish the city of Escanaba with current, and also the company which operates the Escanaba traction system. Similar contracts will be entered into with manufacturing establishments, both at Escanaba and Gladstone. The power-house is in the dam itself, rooms being provided for the turbines and the generators in the lower part of the structure. The approximate cost is $80,000. Watertown (Wis.) men are the controlling factors in the company.

TELEPHONE AND TELEGRAPH.

JEFFERSON, N. H.—The Jefferson Telephone Company is extending its line to Riverton.

FREMONT, NEB.—The new Independent Long-Distance Telephone Company is constructing a line from Omaha to Lincoln.

RONCEVERTE, W. VA.—The Ronceverte Telephone Company will shortly begin operations. The company will start with a service of 125 telephones.

HAGERSTOWN, MD.—The Bell Telephone Company will open an exchange at Blue Ridge Summit this month with approximately 125 stations in the surrounding section.

LINCOLN, ILL.—The Bell Telephone Company is installing a plant in Middletown with J. J. Kinner in charge. When completed it will take care of about 300 subscribers.

MOUNT HOLLY, N. J.—The Farmers' Telephone Company, which operates lines in Burlington, Mercer, Ocean and Monmouth counties, has been sold to the Bell Telephone Company.

SAN FRANCISCO, CAL.—On April 1 the Pacific Telephone and Telegraph Company had a total of 261,562 stations, an increase of 5,119 since the first of the year. This is an average of 13.7 stations per each 100 of population served.

ELVERSON, PA.—Work is progressing on the extension of the Conestoga Telephone line to Warwick. On completing that extension the company contemplates extending in the direction of Loag's Corner, Isabella, Barneston and Wyebrook.

PETERSBURG, VA.—At a meeting of the directors of the Dinwiddie County Telephone Company arrangements were made for the extension of the company's lines as rapidly as possible. Throughout the county many telephones have already been installed.

CANAJOHARIE, N. Y.—The East Springfield Telephone Company, at its recent annual meeting, decided to increase the bond issue from $15,000 to $75,000 and to construct twenty-five miles of toll lines connecting Cherry Valley, Fort Plain and Canajoharie. The old directors were re-elected.

LA CROSSE, WIS.—The Bell Telephone Company has made a contract for exchange of service with the Green Valley Farmers' line which operates throughout southwestern Wisconsin, and has over 300 subscribers. Another has been made with the Standard line of Minnesota, which crosses that state and reaches into Iowa.

PORTSMOUTH, VA.—In order to insure more satisfactory service a new submarine cable will, in the near future, be laid by the Southern Bell Telephone and Telegraph Company between Norfolk and Portsmouth. The new cable is made necessary by the ever-increasing demand by the public for better service across the river.

PEORIA, ILL.—The Farmers' Mutual Telephone Company, of Tazewell County, has been formed with the following officers: John Sommers, of Elm Grove, president, and Frank J. Wilkins, secretary. It is the intention of the company to install exchanges at Groveland, Morton and Tremont. The capital is $25,000. The various townships have already subscribed for over $5,000 worth of stock.

IOWA CITY, IOWA—General Superintendent C. E. Hall, of Des Moines, an official of the Iowa Telephone Company, has asked the council for the privilege of erecting poles, cables and other appurtenances upon the streets of the city. Henry Louis is local manager of the company, which intends to expend something like $50,000 in this city, according to the statement made by the officials. It is proposed to remodel the office system of handling the telephone business entirely and install the central energy system. The outside plant will also be reconstructed and greatly augmented. New instruments will replace the old.

MASON CITY, IOWA—From $75,000 to $100,000 will be expended by the Western Electric Telephone Company, whose head offices are in this city, on its system in northern Iowa. The most extensive piece of work will be the building of a standard line between Rock Rapids and Estherville. Lines will also be built between Mason City and Lake Mills; between Mason City and Green; from Woden to Titonka, thence to Wesley. Copper circuits will be added to the line between Sheldon and Canton, and between Fort Dodge and Algona. Toll lines will be constructed between Sheldon and Bigelow, Minn.; between Estherville and Forest City, and between Rock Rapids and Estherville. The company plans to begin work at once.

EDUCATIONAL NOTES.

WASHINGTON STATE COLLEGE—An electrical and mechanical show was given by the students of the mechanical and electrical department of the Washington State College, at Pullman, Wash., on the evenings of April 8 and 9. The show was very interesting and instructive, and there were many exhibits of scientific interest. The attendance was about 2,500.

THOMAS S. CLARKSON MEMORIAL SCHOOL OF TECHNOLOGY—A chair of physics has been established at the Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y., and is to be filled at the annual meeting, June 10. The work, which will begin September 1, comprises the following: Physics, five periods weekly throughout the college year of thirty-six weeks, sophomore class, forty members; preparation in mathematics, analytic geometry and beginning calculus; physical laboratory, one or more class-unit periods weekly of three actual hours through the year, and to accompany the preceding lectures and recitations; physical chemistry, mathematical physics and seminar, electives for juniors and seniors.

NEW PUBLICATIONS.

AMERICAN GAS INSTITUTE COMMITTEE ON ELECTROLYSIS—The conclusions of the American Gas Institute Committee on Electrolysis and reprints of papers have been compiled and published by Albert F. Ganz, professor of electrical engineering at the Stevens Institute of Technology, consulting electrical engineer to the committee. This reprint includes two papers by Professor Ganz, entitled, respectively, "Theory of Electrolytic Corrosion," and "Electrolysis."

THE POST OFFICE ELECTRICAL ENGINEERS' JOURNAL—The first issue of the *Post Office Electrical Engineers' Journal*, dated April, 1908, has been put in circulation. The journal is the official organ of the Institution of Post Office Electrical Engineers, and will be published quarterly from London, England, by Alabaster, Gatehouse & Company. The principal contents of the first issue are devoted to telegraphs, construction, telephones, wireless telegraphy and telephony. There are also abstracts, institution notes, social notes, correspondence, staff changes, post-office awards for inventions, etc. The standard set in the first issue is indeed very high, and the publication should appeal to all those concerned with the branches of engineering enumerated above.

DATES AHEAD.

Illinois State Independent Telephone Association. Annual convention, Champaign, Ill., May.

Grand Rapids Electrical Show Association. First show, Grand Rapids, Mich., May 11-16.

Ohio Society of Mechanical, Electrical and Steam Engineers. Next meeting, Columbus, Ohio, May 15-16.

Indiana Independent Telephone Association. Annual meeting, Indianapolis, Ind., May 20-21.

National Electric Light Association. Annual meeting, Chicago, Ill., May 19-22.

Telephone Association of Texas and Louisiana. Annual meeting, Dallas, Tex., May 25-27.

Oklahoma Electric Light, Railway and Gas Association. Annual meeting, Guthrie, Okla., May 25-27.

Canadian Electrical Association. Annual meeting, Toronto, Ontario, June 10-12.

Society for the Promotion of Engineering Education. Annual meeting, Detroit, Mich., June 22-27.

American Society of Mechanical Engineers. Semi-annual meeting, Detroit, Mich., June 23-26.

American Society of Civil Engineers. Annual meeting, Denver, Col., June 23-26.

American Institute of Electrical Engineers. Annual convention, Atlantic City, N. J., June 29-July 2.

Street Railway Association of the State of New York. Annual meeting, Niagara Falls, N. Y., June 30-July 1.

National Electrical Contractors' Association. Next meeting, Chicago, Ill., July 15-17.

Michigan Electric Association. Annual meeting, Grand Rapids, Mich., August 18-21.

American Society of Municipal Improvements. Annual meeting, Atlantic City, N. J., October.

PERSONAL MENTION.

MR. WILLIAM PLATTNER, of Bluffton, Ohio, has accepted a position as superintendent of the municipal electric light plant at North Attleboro, Mass.

MR. E. DARWIN, of the Cambridge Scientific Instrument Company, of Cambridge, England, is making his temporary residence in Rochester, N. Y., and is supervising the preparation for the introduction of the "Taylor-Cambridge" types of thermoelectric instruments in America.

MR. W. A. STADELMAN has been elected vice-president of the Darley Engineering Company, which has been formed for the purpose of engineering, manufacturing and selling machinery and appliances for the hoisting and conveying of materials by suction and by air pressure. The company has acquired the sole rights for the United States to manufacture and sell the suction conveyer heretofore controlled by the Economic Engineering and Construction Company, of Chicago, Ill. On May 1 the company took over the business of the Economic Engineering and Construction Company and also the business of the Darley Company, of Pittsburg. W. W. Darley, president, will have charge of the Pittsburg office. Mr. Stadelman and M. D. Chapman, secretary and treasurer, will have charge of the New York office. W. A. Sharp, vice-president, will have charge of the western business, with headquarters in Chicago.

MR. BURY IRWIN DASENT, publicity agent for the Portland Railway, Light and Power Company, Portland, Ore., has accepted the position of manager of the newly organized publicity bureau established to promote interest in the city of Albany, Ore. Mr. Dasent has a wide acquaintance in Portland, where he is prominent in electrical circles, being secretary-treasurer of the Pacific Coast Advertising Men's Association, and secretary of the Portland Rose Festival Association. He will resign the latter position, it is understood, upon leaving the city. For many years Mr. Dasent was engaged in newspaper work in the East, and for eight years was connected with the editorial department of the New York *Herald* as dramatic editor. He was city editor of the Philadelphia *Press* for several years, and assistant city editor of the Philadelphia *Times*. Later he was news editor of the Baltimore *Evening News*. Mr. Dasent went to Portland about three and one-half years ago and took charge of the publicity work of the Portland General Electric Company, which he has continued since the merging of the Portland electrical companies into the Portland Railway, Light and Power Company.

OBITUARY NOTES.

MR. JOHN A. ERNER, president of the Erner Electric Company, Cleveland, Ohio, died on May 6.

MR. FREDERIC H. MAY, formerly vice-president and general manager of the American Rapid Telegraph Company, died on May 10, at his home in Newark, N. J. He had been prominent in railroad construction in the West and Middle West in the seventies and won fame during the Civil War by keeping the Illinois Central north of Cairo open for troop and supply trains for General Grant. Mr. May was born on the Isle of Man.

NEW INCORPORATIONS.

FARMINGTON, N. H.—Cloutman Gas and Electric Company. $15,000.

LANSING, MICH.—Northwest Quincy Telephone Company, Quincy. $1,000.

KELSO, WASH.—Kelso Electric Company, Kelso. $60,000. Incorporators: R. F. Johnson, Albert B. Burcham and others.

OLYMPIA, WASH.—Electric Investment Company, Spokane. $10,000. Incorporators: J. W. Arthur, S. C. Scott and V. G. Shinkle.

MADISON, WIS.—The Southwest Prairie Telephone Company, Sterling, Vernon County. $1,000. Incorporators: A. P. Bringe and others.

HARRISBURG, PA.—The Hamburg Electric Company. $5,000. Directors: William L. Houck, Frank P. Benjamin, William L. Allen, John W. Houck and J. L. Lutsey.

HARRISBURG, PA.—Big Spring Electric Company. To supply light and power to Newville. $15,000. Incorporators: D. H. Heller, of Newville; C. W. Harman and John Hosfield, of Shippensburg.

HARRISBURG, PA.—Schuylkill & Dauphin Traction Company, Pottsville. $25,000. J. W. Moyer, treasurer. To connect towns in the Williams Valley with those in the Hegins Valley and with Pottsville.

ALBANY, N. Y.—Ellenburgh Telephone Company, Ellenburgh Center, Clinton County. $5,000. To do a telephone business throughout Clinton and Franklin counties. Directors: M. W. McGauley, John H. Moore, John Bigelow, O. B. Frazier, C. D. Watson, of Ellenburgh Center; F. L. Myers, of Ellenburgh Depot, and F. H. Gardiner, of Plattsburg.

STAMFORD, CT.—Geneva Railway Securities Company. A holding company to take over the securities held by the Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Company, which operates a street railroad system in the towns named. $567,000. Incorporators: Walter G. Merritt, New York; David B. Henney, Hartford, and James A. McNelus, Brooklyn.

ELECTRICAL SECURITIES.

The market continues to hold firm with higher prices ruling, but there is much speculation as to the ultimate reason for the enlarged trading and improved prices. While there is an undeniable quickening in business affairs, it hardly is of such vigor as to explain the boom in security prices. Reports from railways do not indicate very great improvement, but the crop outlook is very encouraging. Altogether it can most fairly be said that there is little change to be noted.

ELECTRICAL SECURITIES FOR THE WEEK ENDED MAY 9.

New York:	*Closing.*
Allis-Chalmers common	8⅜
Allis-Chalmers preferred	21¾
Brooklyn Rapid Transit	47⅞
Consolidated Gas	120¾
General Electric	136½
Interborough-Metropolitan common	10½
Interborough-Metropolitan preferred	28⅝
Kings County Electric (ex interest)	118
Mackay Companies (Postal Telegraph and Cables) common	63⅜
Mackay Companies (Postal Telegraph and Cables) preferred	64
Manhattan Elevated	134½
Metropolitan Street Railway	25
New York & New Jersey Telephone	105
Western Union	51
Westinghouse Manufacturing Company	46½

Boston:	*Closing.*
American Telephone and Telegraph	117½
Edison Electric Illuminating	—
Massachusetts Electric	—
New England Telephone	113
Western Telephone and Telegraph preferred	65

Philadelphia:	*Closing.*
Electric Company of America	10
Electric Storage Battery common	32¾
Electric Storage Battery preferred	32¾
Philadelphia Electric	8¾
Philadelphia Rapid Transit	18
United Gas Improvement	86¾

Chicago:	*Closing.*
Chicago Telephone	118½
Commonwealth Edison	91½
Metropolitan Elevated preferred	49
National Carbon common	60
National Carbon preferred	107

The Chicago Telephone Company has 7,000 orders ahead, besides a gain of 2,346 instruments last month. Since January 1 the increase has been 11,352, as against 11,658 a year ago. The total now is 214,240, as against 182,617 a year ago, one-third of the increase having been made this year.

April traffic on the four elevated roads showed a decrease of 237,013 passengers as compared with that of March. The totals follow: Metropolitan, 4,399,138; South Side, 3,536,558; Northwestern, 3,107,091; Oak Park, 1,446,652; a total of 12,489,439. The corresponding figures for April, 1907, are: Metropolitan, 4,688,257; South Side, 3,094,553; Northwestern, 2,704,037; Oak Park, 1,507,458; a total of 11,994,305. The Metropolitan Elevated Company has arranged the sale of the balance of its extension mortgage bonds, amounting to $1,170,000, to clear up the floating debt, which totals about $1,370,000, including $536,525 equipment trust notes.

ELECTRIC RAILWAYS.

SAN BERNARDINO, CAL.—The Redlands & Yucaipa Electric Railroad has given a $500,000 mortgage to the Title, Insurance and Trust Company, of Los Angeles, to secure the issue of 500 $1,000 five per cent bonds. Construction work will now be pushed.

ABERDEEN, S. D.—The city council has been asked to grant franchise rights to a Huron concern to construct terminals in this city for an electric interurban road to run between Aberdeen and that town. The proposition was submitted by J. A. Cleaver, of Huron.

HASTINGS, MICH.—The common council of Hastings, Mich., has granted a franchise for an electric railroad to John E. More, of Grand Rapids. The road is to carry both passengers and freight. It must be in operation by December 31, 1909, or the franchise will be forfeited.

PARKERSBURG, W. VA.—H. W. McCoy, of Sistersville, has purchased the property of the Wetzel & Tyler Electric Railway Company in Tyler County, exclusive of movable property, for $15,644, which is the amount of a judgment rendered in the United States court in favor of Tennis Brothers, together with the costs and interest.

TOLEDO, OHIO—After years of litigation the city and the Toledo Railways and Light Company have completed a settlement of all claims and counter-claims. By the terms of this settlement the city will be paid $242,612.45. The total claims of the city amount to $551,765.54. It is believed that the company will now submit a franchise proposition.

DES MOINES, IOWA—A new interurban railway, 106 miles in length, from Red Oak, Iowa, to Des Moines, is being promoted. As at presented planned, the route will take in Grant, Greenfield, Stuart, Redfield, Adel and Waukee. Of the directors of the company, eight are in Red Oak, two in Grant, three in Greenfield, two in Stuart, two in Redfield, two in Adel and one in Waukee. The new interurban is to be managed entirely by the people of the cities included in the route.

GENEVA, N. Y.—Representatives of the Geneva, Seneca Falls, Waterloo & Cayuga Lake Traction Company state that the Geneva Securities Company, organized in Connecticut with a capital of $567,000 for the purpose of handling the securities of the traction company, is part of the plan for the rehabilitation of this company. The Securities company will market the securities, which are for the purpose of rebuilding the road between here and Cayuga Lake and putting on new rolling stock and new equipment.

ROCHESTER, N. Y.—The Public Service Commission has given its permission for the construction of an extension of the Rochester Electric Railway Company's lines in the village of Charlotte. The commission has also authorized the Rochester Railway and Light Company (which controls the former company), to issue five per cent consolidated mortgage bonds, redeemable at 103, under the mortgage dated June 15, 1904, securing a total issue of $16,000,000. The total amount of the bonds at par shall not exceed $1,637,000.

SPRINGFIELD, MASS.—The Springfield Street Railway Company has filed with the railroad commissioners its petition for an increase of capital stock by $500,000, while the Berkshire Street Railway Company asked for an extra $285,000. Vice-President and General Manager H. C. Page, of the Springfield Street Railway Company, said that the additional stock would be put out for the purpose of caring for floating indebtedness. The capital of the company, according to the last report of the railroad commissioners, was $2,258,100.

NEWARK, OHIO—It is announced that the full amount of the capital stock of the Ohio, Lake Erie & Eastern Electric Railway Company, incorporated to build an electric line from Newark to Wooster, has been subscribed, and that at a meeting of the board of directors the issuing of $2,000,000 bonds for the construction of the road was authorized. The company's financial representative has left for Belgium where arrangements for the financing of the enterprise will be completed. The Savings and Trust Company of Mount Vernon has been named as trustee for the bonds. The organization was completed by the election of the following officers: Frank V. Owen, president; J. F. Schrontz, vice-president; J. F. Chilcote, treasurer; F. E. Elliott, secretary, and Edward Kibler, counsel.

INDUSTRIAL ITEMS.

THE LOUREY ELECTRIC COMPANY, Berkeley, Cal., is in the market for a line of electrical specialties. It is suggested that electrical manufacturers communicate with this company.

THE DEARBORN DRUG AND CHEMICAL WORKS, Chicago, Ill., manufacturing and analytical chemists and chemical engineers, have published a large calendar for distribution to the trade.

THE GUARANTY ELECTRIC HEATER COMPANY, Cleveland, Ohio, has been organized by W. J. Barr to manufacture his well-known line of heating devices. Offices will be established at 1686 West Third street.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., announces that its district office at San Francisco, Cal., in charge of H. D. Scribner, has been removed from the Atlas Building to the Phillips Building, 599 Mission street.

THE FORT WAYNE ELECTRIC WORKS, Fort Wayne, Ind., announces that its New York office, formerly located at 40 New street, has been removed to the Cortlandt Building of the Hudson Terminal, with entrance at 30 Church street. The Fort Wayne Electric Works will occupy a part of the fifteenth floor.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., has issued a new trade discount and price list applying to its 1906-1907 general catalogue. This price list cancels all previous quotations and now contains the most up-to-date prices of electrical appliances sold by the company. It is dated May, 1908, and is now being distributed. Holders of the catalogue who do not receive a copy of this price list are requested to make application for it.

THE HOLOPHANE COMPANY, 227 Fulton street, New York city, has issued a special edition of "Holophane," describing Holophane "Luxoliers." This is a very attractive line of lighting devices which has been developed for the use of incandescent lamps with special electrical glassware. Copies of this issue will be furnished upon request. The company has also prepared a bulletin devoted to Holophane tungsten "Luxoliers," which it will be pleased to send to those interested.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Ct., in the May issue of "Trumbull Cheer," presents a brief sketch of the development of the company, illustrated with views of the various departments. The progress of the Trumbull company has been rather remarkable, and it has made for itself an enviable reputation and position in the electrical field. The company is also calling attention to its "Kappa" switches, upon which it is quoting some very attractive figures.

THE ELECTRIC CONTROLLER AND SUPPLY COMPANY, Cleveland, Ohio, has published bulletin No. 281, devoted to crane fittings, crane switchboards, knife switches, circuit-breakers, type B rosettes, cast-grid resistance, coil resistance, type B limit stops, "Universal" insulator supports, and Baehr flexible couplings. This company's way of doing things is always exceptional, and the present bulletin carries out this characteristic. The illustrations are splendidly worked out, the descriptive matter is complete, and the facility with which any information can be found is especially noteworthy

THE AITON MACHINE COMPANY, 126 Liberty street, New York city, announces that it has made connections with the Samuel L. Moore & Sons Corporation, Carl D. Bradley, president, of Elizabethport, N. J., for the manufacture and sale of Aiton machinery. The company will in the future solicit patronage in the name of the Samuel L. Moore & Sons Corporation. Thomas A. Aiton, vice-president of the Aiton Machine Company, will make his headquarters at the plant of the Moore corporation at Elizabethport. All business connected with the Aiton Machine Company will receive his personal direction and supervision.

THE INTERNATIONAL HELP-A-PHONE COMPANY, 1133 Broadway, New York city, is placing on the market the Rector "Help-a-Phone." This device is intended to render more distinct and natural the conversation received over a telephone. By an arrangement in an intersecting piece, sound is conveyed through the tube to the ear-piece, which, when applied to the ear with the receiver at the other ear, not only renders the sound more distinct on account of bringing into use the hearing faculties of both ears as in ordinary conversation, but excludes all outside and disturbing influences. Essentially, the "Help-a-Phone" is a watch-

case receiver attached by a tube to a cap which takes the place of the screwed-on cap in the ordinary hand receiver. The company announces the use of this instrument by a large number of corporations throughout the country. The officers of the company are: William McAdoo, president; Daniel O. Sprague, vice-president and treasurer, and Alcorn Rector, secretary. Charles R. Osborne is general representative.

THE H. W. JOHNS-MANVILLE COMPANY, New York city, announces that its business interests in the city of Detroit and the territory adjacent thereto have increased to such an extent that a new branch is about to be opened by the company. This branch will be located at 72 Jefferson avenue, Detroit, under the management of Willard K. Bush, who is well and favorably known throughout that section of the country, having been connected with the Milwaukee branch for a number of years. A complete stock of goods will be carried at the Detroit branch, so that shipments can ordinarily be made direct from that office.

THE LINCOLN MOTOR WORKS COMPANY, Cleveland, Ohio, formerly the Lincoln Electric Manufacturing Company, is distributing a new sixteen-page bulletin devoted to a full description of Lincoln variable-speed motors. This includes detail drawings, speed and efficiency charts, table of ratings, and general outline dimensions. The bulletin also describes fully the principle of operation of this type of variable-speed motors and its peculiar advantages for all forms of individual drive requiring variable speeds. There are also shown a number of illustrations typical of the application of these motors to machine-tool drive. Copies of the bulletin will be sent to any person interested upon request.

THE WESTERN ELECTRIC COMPANY, Chicago, Ill., manufactures all kinds and sizes of telephone cables for aerial, underground and submarine use. In the construction of this material the utmost care is used in the selection of the raw material, the manufacture of the cable, and finally in testing it to make sure that it meets the company's rigid specifications. The managers of telephone companies realize the many benefits derived from the use of cable, and are now using it very largely for construction work. It is, however, vitally important that the best cable be used, as an improperly designed cable will materially reduce the distance over which a conversation may be carried on, introduce cross-talk, impair the transmission, and seriously affect the earning power of the telephone system. The standard Western Electric cable has a high insulation resistance and a low capacity between conductors. It will therefore reduce the cross-talk, improve the transmission and allow conversations to be carried on over toll lines of great length. Complete information and prices will be sent upon request.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY, 42 West Jackson Boulevard, Chicago, Ill., reports a very gratifying demand for its new separable wireless cluster, which was described in the issue of the ELECTRICAL REVIEW for January 11. It will be remembered that this separable wireless cluster is a long step in advance, and is a device that meets particularly well the requirements of the contractor and installing engineer. The facility with which this cluster can be handled by dealers is also proving to be a great factor in making it popular in every part of the country. The company states that, in view of the present demand, the statement seems warranted that, to all intents and purposes, this cluster will be accepted by the trade as the standard wireless cluster.

THE TAYLOR INSTRUMENT COMPANIES, Rochester, N. Y., sole American agent and manufacturer for the Cambridge Scientific Instrument Company, Limited, Cambridge, England, has published a very handsome catalogue devoted to electric thermometry, radiation pyrometers, thermoelectric thermometers and resistance thermometers. Among the instruments illustrated and described are: Fery radiation pyrometers with indicator or thread recorder. One type of this apparatus measures temperatures from 1,500 degrees Fahrenheit upward; another, from 900 degrees to 2,200 degrees Fahrenheit, and another from 400 degrees to 1,500 degrees Fahrenheit. All the recording instruments give records which are clearly visible at all times over a considerable length of the record. The records are easy to read because they all have rectangular co-ordinates —that is, all time and temperature lines are straight, not curved. The records are read direct in temperatures without corrections. All records are produced directly in ink. All thermometers are interchangeable with others of the same type. There are illustrated thermoelectric thermometers of the LeChatelier type, thermoelectric thermometry recorders, thermo-couples, thermometry indicators, resistance thermometry indicators, all in wall, switchboard and portable types.

Record of Electrical Patents.

Week of May 5.

886,338. PRINTING TELEGRAPH. John C. Barclay, New York, N. Y., assignor to Western Union Telegraph Company, New York, N. Y. A telegraph system, transmitting by means of an alternating current, means being provided for prolonging one of the current pulses at will.

886,339. AUTOMATIC TELEGRAPH TRANSMITTER. John C. Barclay, New York, N. Y. A combination message-feeding mechanism with an automatic transmitting contact and an independent transmitter separately controlled.

886,355. INVISIBLE ELECTRIC BURGLAR AND FIRE ALARM. James W. Dawson, Kansas City, Mo. An open-circuit system, the alarm contacts being arranged in pairs, one of which is closed by the withdrawal of an insulating plug, and the other, by the insertion of a conducting plug.

886,371. SYSTEM OF ELECTRICAL DISTRIBUTION. Albert S. Hubbard, Belleville, N. J., assignor to Gould Storage Battery Company. A system of charging and regulating storage batteries, utilizing a plurality of compound-wound generators grouped in parallel.

886,372. ELECTRICAL SYSTEM OF DISTRIBUTION. Albert S. Hubbard, Greenwich, Ct., assignor to Gould Storage Battery Company. A storage-battery regulating system utilizing a main generator and a compensatory circuit in parallel with the former.

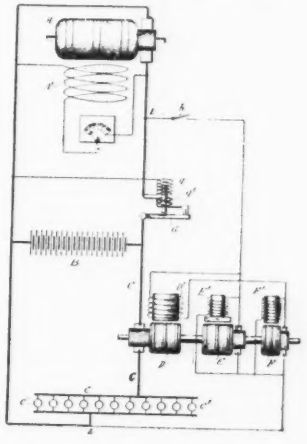
886,374. HEAT-COIL AND PROTECTOR UNIT. William Kaisling, Chicago, Ill., assignor to Frank B. Cook, Chicago, Ill. A heat-coil and carbon arrester for protecting telephone lines.

886,395. SYSTEM OF ELECTRICAL REGULATION. Morris Moskowitz, New York, N. Y., assignor to the United States Light and Heating Company. A battery charging system employing a shunt generator and a regulator for varying the field excitation.

886,443. VIBRATOR. Egmont M. Tormin, Newton, Mass., assignor to Holtzer-Cabot Electric Company. The vibrator magnet is connected in the secondary circuit of a transformer.

886,445. CAR-LIGHTING SYSTEM. William A. Turbayne, Lancaster, N. Y., assignor to Gould Coupler Company. A dynamo-crusher is driven by a motor connected across the batteries.

886,497. SYSTEM AND APPARATUS FOR TELEPHONE LOCAL TOLL OR PAY STATIONS. James Harrison, St. Louis, Mo. Means are provided for refunding the coin.



886,445.—CAR-LIGHTING SYSTEM.

886,498. SYSTEM FOR MEASURED TELEPHONE SERVICE. James Harrison, St. Louis, Mo. An electromagnetic counter is operated by a manually operated key.

886,499. TELEPHONE TOLL BOX. James Harrison, St. Louis, Mo. Means are provided for refunding the first coin and retaining the succeeding ones.

886,517. TROLLEY HARP. Hugh W. Kimes, Dayton, Ohio, assignor of two-thirds to J. H. Vaile, Dayton, Ohio. A split collar is clamped on the axle of the wheel.

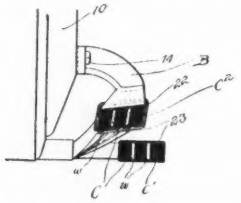
886,559. BRUSH-HOLDER. William L. Waters, Milwaukee, Wis., assignor to National Brake and Electric Company, Milwaukee, Wis. The holder is pivoted on a supporting roller and held in place by a helical spring.

886,561. COIL SUPPORT. William L. Waters, Milwaukee, Wis., assignor to National Brake and Electric Company, Milwaukee, Wis. A support extending axially and inwardly from the face-plate.

886,562. DYNAMOELECTRIC MACHINE. William L. Waters, Milwaukee, Wis., assignor to National Brake and Electric Company, Milwaukee, Wis. The brush yoke is mounted on the bearing frame and provided with insulated slots.

886,566. ELECTRIC CABLE. Charles E. Wilson, Philadelphia, Pa. The different strands are of conductive material, differing in magnetic permeability.

886,620. ELECTRIC SIGNALING APPARATUS FOR RAILROADS. Paul J. Matter, Coswig, Germany. A block system, the successive sections being insulated from one another.



886,561.—Coil Support.

886,645. TROLLEY-GUARD. Jean E. Saucier, Montreal, Quebec, Canada. A roller is carried on arms extending rearwardly of the wheel.

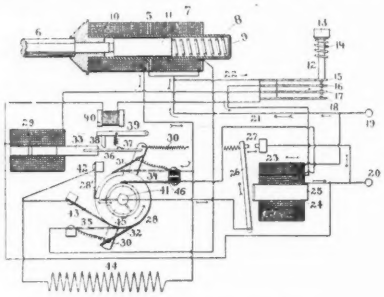
886,649. BATTERY COVER AND ELEMENT SUPPORT. Charles B. Schoenmehl, Waterbury, Ct. The cover of insulating material extends down so as to protect the connecting lug from the electrolyte.

886,650. BATTERY COVER AND ELEMENT SUPPORT. Charles B. Schoenmehl, Waterbury, Ct. An electrode-supporting device with a depending, longitudinally extended sleeve.

886,651. NEGATIVE ELEMENT FOR PRIMARY BATTERIES. Charles B. Schoenmehl, Waterbury, Ct. A compressed metal oxide battery element.

886,652. ELECTRIC BATTERY. Charles B. Schoenmehl, Waterbury, Ct. A thin pressed cylinder of metallic oxide held by a perforated metal sheet.

886,676. AUTOMATIC ELECTRIC SIGNAL SYSTEM FOR RAILWAYS. John P. Buchanan, Cleveland, Ohio, assignor of one-half to Frederick B. Wiegand, Cleveland, Ohio. A signaling system utilizing the ground as part of the circuit.



886,678.—Electric-Driven Tool.

886,678. ELECTRIC-DRIVEN TOOL. Allen F. Carver, New York, N. Y. A coil-and-plunger device.

886,682. ELECTRIC HEATER AND RHEOSTAT. James H. Delaney, Berwyn, Ill., assignor to the Electric Controller and Supply Company, Cleveland, Ohio. The resistance element is a beveled strip wound on edge.

886,740. RELAY FOR SIGNALING APPARATUS. Louis H. Thullen, Edgewood Park, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. An alternating-current relay provided with two windings and a laminated core.

886,755. TELEGRAPH INSTRUMENT. Benjamin F. Bellows and Ambrose Behner, Cleveland, Ohio; said Behner assignor to said Bellows. One end of the electric circuit is attached to a slowly moving vibrator.

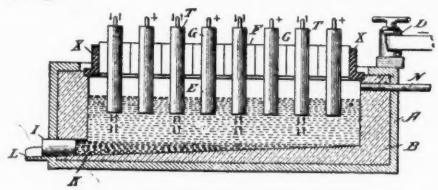
886,757. ART OF REDUCING ALUMINUM AND OTHER METALS. Henry S. Blackmore, Mount Vernon, N. Y. The materials are fused by a non-metal-yielding current and electrolyzed by a metal-yielding current.

886,811. ELECTRICAL CONNECTION. George H. Jacob and John L. Hagadorn, Detroit, Mich. A flush plug for extension circuits.

886,821. ELECTRIC INCANDESCENT LAMP. Hans Kuzel, Baden, near Vienna, Austria-Hungary. The horseshoe-shaped filaments are mounted spirally and supported at several points.

886,824. CHOKE-COIL. Louis O. Langworthy, Bradford, Pa. A coil with two cores and an adjustable air-gap.

886,842. ELECTRIC RAILWAY GATE. Richmond M. McGee, Dallas, Tex., assignor to McGee Switch and Signal Company, Dallas, Tex. An electrically operated, electrically controlled railway gate.



886,757.—Art of Reducing Aluminum and Other Metals.

886,856. ELECTRIC FURNACE. Edgar F. Price, Niagara Falls, N. Y., assignor, by mesne assignments, to Central Trust Company, of New York, trustee. A furnace with a smelting chamber and a plurality of separate receptacles for retaining the molten material.

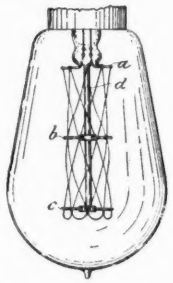
886,857. ELECTROLYTIC PROCESS OF PRODUCING METALS. Edgar F. Price and William S. Horry, Niagara Falls, N. Y., assignors, by mesne assignments, to Central Trust Company, of New York, trustee. A molten salt of the desired metal is electrolyzed with an anode formed of a carbid of that metal.

886,858. PROCESS OF PRODUCING LOW-CARBON FERRO-ALLOYS. Edgar F. Price, Niagara Falls, N. Y., assignor to Electro Metallurgical Company, Chicago, Ill. A ferro-alloy, high in carbon, is reduced by heating in an induction furnace.

886,869. ELECTROMAGNET. Harold Rowntree, Chicago, Ill., assignor to Burdett-Rowntree Manufacturing Company, Chicago, Ill. A magnet for alternating currents having a laminated core made solid at one end.

886,870. ELECTROMAGNET. Harold Rowntree, Chicago, Ill., assignor to Burdett-Rowntree Manufacturing Company, Chicago, Ill. A magnet with a laminated core solid at one end and a tapered winding.

886,874. APPARATUS FOR PRODUCING ELECTRIC DISCHARGES THROUGH GASES. August Schneller, Ginneken, near Breda, Netherlands, assignor to Percy Thompson, East Orange, N. J. A flowing medium is circulated through the discharging points for cooling them.



886,821.—Electric Incandescent Lamp.

886,879. SIGNALING SYSTEM. John Shepherd, Chicago, Ill. A signaling system operated by a brake in the ground circuit.

886,880. TROLLEY. John Shepherd, Chicago, Ill. A trolley harp with a self-lubricating axle.

886,909. PARTY-LINE TELEPHONE SELECTOR AND LOCKOUT. Herbert D. Williams, Vermilion, Kans. Means are provided for locking all except the called instrument.

886,942. TROLLEY-LINE CLAMP. Auguste Caron, Indian Orchard, Mass. A clamp formed of two separable curved members.

886,993. ELECTRIC SIGNAL FOR RAILWAYS. Anton Kuzel, Cleveland, Ohio. A safety signal operated by a trip device on the track.

887,038. DUPLEX TELEGRAPH. John J. Ghegan, Newark, N. J. A relay and resistance in the line, each of which is shunted by an adjustable circuit.

887,052. ELECTRICAL SYSTEM OF DISTRIBUTION. Walter E. Winship, New York, N. Y., assignor to Gould Storage Battery Company. A combination of an alternating-current system with a motor generator and storage battery.